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October 22, 2015

Reference No. 054046

Mr. Bradley Roberts
U.S. Environmental Protection Agency, Region 7
Air and Waste Management Division
Waste Remediation and Permitting Branch
11201 Renner Boulevard
Lenexa, Kansas 66219

Via FedEx

Dear Brad:

Re: Corrective Measures Study Work Plan
Occidental Chemical Corporation
6200 S. Ridge Road, Wichita, Sedgwick County, Kansas
RCRA ID# KSD007482029

On behalf of Glenn Springs Holdings, Inc. and the Occidental Chemical Corporation, Wichita, Kansas Facility, please find enclosed the final report entitled "Corrective Measures Study Work Plan". Enclosed are two hard copies and two copies on compact disk.

If you have any questions regarding the attached report, please do not hesitate to contact me at (773) 380-9234 or David Anderson at (972) 687-7508.

Yours truly,

GHD

B. Clegg

Bruce Clegg

BCC/lg/28

RCRA

548427

Encl.

cc: Mostafa Kamal, KDHE
David Anderson, Glenn Springs Holdings, Inc.
Lisa Thurman, OCC, Wichita, Kansas

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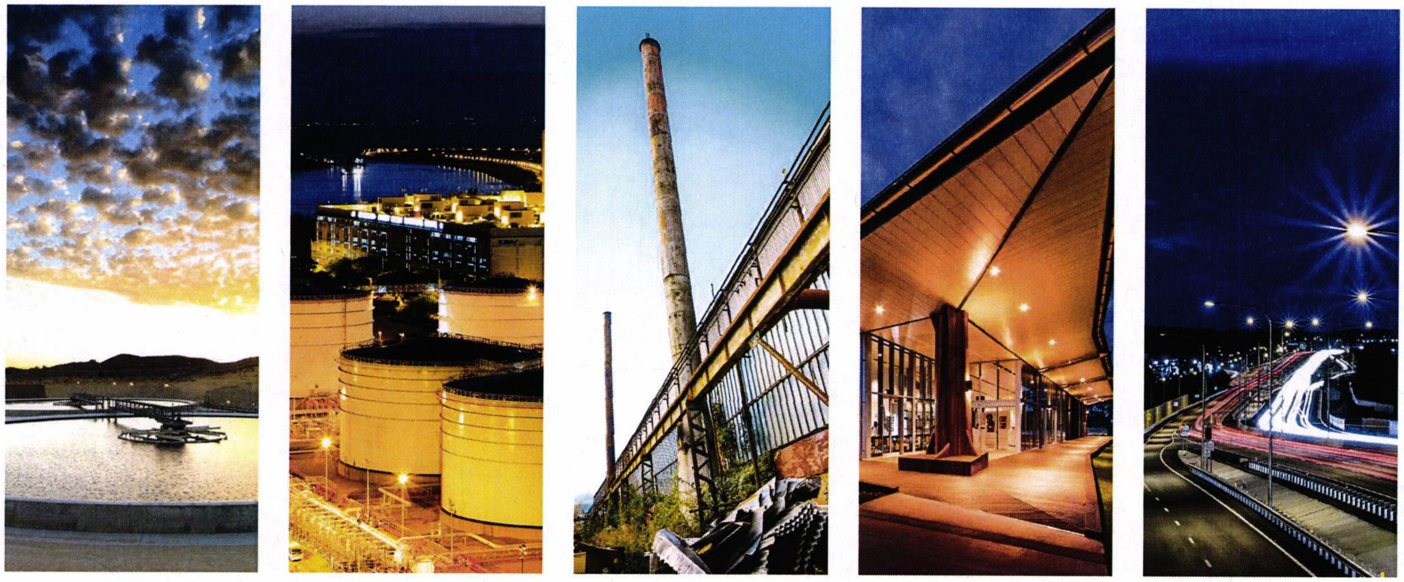

Corrective Measures Study Work Plan

Occidental Chemical Corporation Facility
Wichita, Kansas
EPA ID #KSD007482029

Glenn Springs Holdings, Inc.

6400 Shafer Court – Suite 400 Rosemont Illinois 60018
054046 | D22113 | 403 | Report No 46 | October 22 2015

Table of Contents

Figure Index

Table Index

Appendix Index

Acronyms and Abbreviations

ASI	Asbestos Surface Impoundment
CAO	Corrective Action Objective
CMS	Corrective Measures Study
COC	Contaminant of Concern
DNAPL	Dense Nonaqueous Phase Liquid
EPA	Environmental Protection Agency
FIRST	Facilities Investigation Remedy Selection Track
GHD	GHD Services, Inc.
GSH	Glenn Springs Holdings, Inc.
HHRA	Human Health Risk Assessment
HSWA	Hazardous and Solid Waste Amendments
HVAC	Heating, Ventilation and Air Conditioning
ICM	Interim Corrective Measures
KDHE	Kansas Department of Health and Environment
OCC	Occidental Chemical Corporation
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
U.S.	United States
VI	Vapor Intrusion
VCI	Voluntary Cleanup Investigation

1. Introduction

This Resource Conservation and Recovery Act (RCRA) Corrective Measures Study (CMS) Work Plan was prepared by GHD Services, Inc. (GHD) on behalf of Glenn Springs Holdings, Inc. (GSH) for the Occidental Chemical Corporation (OCC) Wichita, Kansas, Facility (Site or Wichita Facility or Facility) located at 6200 S. Ridge Road, Wichita, Sedgwick County, Kansas (United States [U.S.] Environmental Protection Agency [EPA] ID #KSD007482029), **Figure 1**. This Work Plan was prepared in accordance with Part II of the Facility's 2007 RCRA/Hazardous and Solid Waste Amendments (HSWA) operating permit (Permit) [1], RCRA regulations at 40 CFR 264.100 (Corrective Action), and relevant guidance documents [2,3], including the RCRA Facilities Investigation Remedy Selection Track (FIRST) [4]. This CMS Work Plan outlines the objectives, approach, evaluation criteria and schedule for conducting CMS activities for the Site.

This CMS Work Plan is based on the site investigation information obtained during the RCRA Facility Investigation (RFI) performed from 2009 to 2014 [5,6,7] and the Human Health Risk Assessment (HHRA) [8].

1.1 Purpose

A RCRA FIRST analysis of Region 3 and Region 7 site data concluded that the CMS work plan-review-approval part of a remedy selection takes an average of nearly six years [4]. The remedy selection process for the Wichita Facility as outlined in this work plan proposes to significantly improve upon that typical timeframe, despite the relative Site complexity. In part, the remedy selection process will be achieved through the recognition of existing effective Interim Corrective Measures (ICMs) for soil, groundwater, vapor intrusion (VI) and the closed landfill as components of the final remedy to address long-term Corrective Action Objectives (CAOs) for an active chemical facility and will align with the RCRA FIRST principles. **Figure 2** presents the streamlined approach to the CMS for the Wichita Facility.

The purpose of this CMS work plan is to present the selection criteria and methodology by which GSH will evaluate and select corrective measures alternatives to address contaminant of concern (COC) impacts in environmental media (soil, groundwater, and soil vapor) at the Site in accordance with Part II Section C.8 of the Facility's RCRA Permit. This work plan includes the following sections:

Section 1-Introduction

Section 2-Site Background

Section 3-CMS Objectives

Section 4-CMS Approach

Section 5-Data and Information Sources

Section 6-CMS Report Outline

Section 7-CMS Schedule

Section 8-References

2. Site Background

The Wichita Facility has been an active chemical plant since 1952 and is located in a rural industrial and agricultural farming area. The current Facility layout is presented on **Figure 3.** A comprehensive discussion of the Facility's operational history and waste disposal practices is summarized in the Comprehensive RCRA Facility Investigation Summary Report [5] and the Phase II Groundwater RFI [6].

OCC acquired the Wichita Facility from Vulcan Chemical in 2005. Following renewal of the Permit in 2007, an RFI Schedule of Work was agreed upon by U.S. EPA and GSH in 2008 in order to address revised HSWA requirements identified in Part II of the Permit, including investigation of over 150 Solid Waste Management Units (SWMUs) and Areas of Concern (AOC). The conclusions of the RFI identified a subset of SWMUs and AOC locations requiring further analysis in the HHRA and CMS (**Figure 4**). Whereas the average timeframe for an RFI for U.S. EPA sites (including Region 7) is approximately 10 years [4], the RFI for the OCC Wichita Facility was completed and approved in a little over six years following establishment of the Permit Schedule of Work. Substantial corrective measures for groundwater and VI were completed during the same time.

2.1 Interim Corrective Measures

ICMs have been initiated and are currently operating at the Wichita Facility. These ICMs will continue to be operated as ICMs until the final corrective action decision is implemented following completion of the CMS. The ICMs at the Site are summarized below.

2.1.1 Groundwater Interceptor Well System

The Groundwater ICM consists of 14 interceptor wells screened in separate sand aquifers beneath the Facility and surrounding areas. The locations of the interceptor wells are shown on **Figure 5**. The interceptor wells operate in the two aquifer zones to maintain cones of depression within the aquifers to prevent the migration of contaminants [9]. The ongoing effectiveness of the Groundwater ICM is monitored through the semi-annual groundwater gauging and sampling events.

2.1.2 Vapor Intrusion Mitigation System

A 2009 evaluation of the VI pathway for the Administration, Control Laboratory, and Technical Center (R&D Laboratory) buildings (**Figure 6**) indicated that compounds present (or potentially present) in underlying soil gas necessitated an ICM to address any potential concern. The VI ICM minimizes the potential for building occupants to be exposed to chemicals that are present or potentially present in soil gas beneath the building by utilizing positive pressurization via the normal heating, ventilation, and air conditioning (HVAC) equipment to induce a positive pressure inside the building [10]. The HVAC equipment in the Administration Building was upgraded in 2010, and pressure monitors were installed in the Administration Building, Technical Center, and the Control Laboratory. The Wichita Facility completes quarterly inspection and monitoring of the VI ICM and provides the information in the Quarterly Corrective Action Report [11].

2.1.3 Landfill Area Cap

The Alpha Cake Landfill, Hex Waste Pits, and the Brine Ponds (Landfill Area) collectively comprise approximately 40 acres at the southeast portion of the Site (**Figure 6**) and were closed in 1977 [12]. The closure includes a two-foot thick compacted clay cap covered with four feet of soil fill material

[13,14]. As documented in the 1988 Canonie Environmental Engineer's Report, *Closed Landfill Evaluation, Chloralkali/Chlorosolvent Manufacturing Plant* [13], a comprehensive barrier exists to prevent both direct contact and stormwater infiltration. Additionally, the clay soils comprising the landfill cap have low hydraulic conductivities which serve as a hydraulic barrier to underlying soils [14]. The perimeter of the Landfill Area is surrounded by a chain-link fence. Periodic inspections as well as maintenance and repairs are performed on the final cap as necessary.

2.1.4 Asbestos Surface Impoundment Cap

The approximate location of the former Asbestos Surface Impoundment (ASI) is located in the southern portion of the Site shown on **Figure 6** and was used between 1952 and 1977 to dispose diaphragm cell regeneration wastes. In 1977, the plant began disposal of asbestos-containing wastes at off-site licensed disposal facilities and use of the ASI was discontinued. Subsequent construction in the vicinity of the ASI resulted in covering and filling the ASI with soil, gravel, and concrete pavement. During routine maintenance activities in June 2005, asbestos-containing materials were identified in a gravel area in the vicinity of the No. 4 Cooling Tower [15]. The Wichita Facility implemented an ICM by capping the ASI with concrete. The concrete provides an impervious surface and allows for machinery to be utilized in the area during cooling tower maintenance. Much of the surrounding area consists of asphalt or concrete. The Wichita Facility has a preventative maintenance program which requires routine inspection of concrete areas to monitor and confirm durability and sustainability.

2.2 Off-Site Sources

Two other properties adjacent to this Facility have active site investigations: the former Arkema Facility and the Gavilon Grain Facility (**Figure 7**). A voluntary cleanup investigation (VCI) was undertaken by Arkema under the oversight of the Kansas Department of Health and Environment (KDHE). These activities were summarized in a Comprehensive VCI Summary Report [16]. Based on the generated data, the summary report recommended that a focused feasibility study be developed to address impacted media. The VCI was completed in two phases.

In 2014, the KDHE completed two groundwater investigations at and near the Gavilon Grain Facility (north of the OCC Facility). The results of the KDHE's investigation confirmed a separate carbon tetrachloride groundwater contamination source emanating from the Gavilon Grain Facility [17]. The nature and extent of this source has not been fully delineated.

2.3 Human Health Risk Assessment

The HHRA [8] for the Site evaluated four Exposure Areas at the Site: Process Area, Non-Process Area, Landfill Area, and the Off-Site Area (**Figure 3**). The Process Area, Non-Process Area and Landfill Area are owned by OCC and are within the Facility boundary. The Off-Site Area is outside the Facility boundary. The HHRA concluded that the soil exposure pathway is complete for workers, and trespassers at the Process Area and Landfill Area. The HHRA concluded that the groundwater exposure pathway is complete for workers in the Process Area, Non-Process Area, and for future residents in the Off-Site area. **Table 1** summarizes the HHRA conclusions for the Exposure Areas at the Site. The HHRA concludes that ICMs currently in place are effectively interrupting exposure pathways for potential receptors in each of the Exposure Areas. The VI pathway was not evaluated in the HHRA; GSH will prepare a separate work plan to evaluate the potential for VI in the Process Area and Landfill Area and will provide the work plan to U.S. EPA for review and approval.

3. CMS Objectives

The goal of the CMS is to identify corrective measures that will effectively mitigate impacts to soil and groundwater in a manner that provides short-term and long-term protection of human health and the environment to the extent practicable. The CMS CAOs are intended to be specific to the affected media (i.e., soil, soil vapor and groundwater) without overly restricting the potential remedial technology available. The CAOs are based on requirements listed in the Permit [1] as well as exposure pathways identified in the HHRA. The CAOs for soil and groundwater are presented below:

Soil CAOs:

- Control sources of releases that may pose a threat to human health or the environment in the Process Area and Landfill Area
- Reduce or eliminate direct contact by a potential receptor (including ingestion, inhalation, and dermal adsorption) with COCs in soil in the Process Area and Landfill Area
- Reduce or eliminate the potential for COCs in soil to migrate to groundwater in the Process Area and Landfill Area

Groundwater CAOs:

- Attain cleanup standards set by, or risk-based standards approved by, U.S. EPA where practicable in the Process Area, Non-Process Area, Landfill Area and Off-Site
- Control sources of releases that may pose a threat to human health or the environment in the Process Area, Non-Process Area, Landfill Area and Off-Site
- Reduce or eliminate direct contact by a potential receptor (including ingestion, inhalation, and dermal adsorption) with COCs in the Process Area, Non-Process Area, Landfill Area, and Off-Site

4. CMS Approach

The CMS will be streamlined to facilitate media-specific remedy selection following the principles outlined in the U.S. EPA's RCRA Corrective Action Plan Final [2] and RCRA FIRST Toolbox to evaluate existing ICMs and remedial technologies to expedite final corrective measure alternative selection and implementation at the Site (**Figure 2 and Table 2**). Therefore, the CMS will focus on existing ICMs and a limited set of plausible remedies for soil, groundwater, soil vapor, and dense nonaqueous phase liquid (DNAPL). The existing ICMs and existing remedial technologies will be evaluated against the threshold criteria outlined in **Section 3** as well as balancing criteria including the following:

- Long-term reliability and effectiveness
- Reduction of toxicity, mobility, or volume of wastes
- Short-term effectiveness
- Implementability
- Cost

The selected corrective measures alternative will be the alternative which can most effectively accomplish the CMS objectives. The following sections outline the CMS approach in more detail.

4.1 Soil

Soil ICMs are in place and complete in the Landfill Area and the ASI (**Figure 6**). Since this Site is an active chemical facility, large portions of the Site soils are covered with impervious or low-permeability caps (**Figure 8**). Existing soil remedial technologies include excavation, capping, security barriers and institutional controls. These existing technologies will be evaluated for soil in the CMS (**Figure 2 and Table 2**) and they are summarized below.

4.1.1 Excavation

Soil excavation is an effective means of source and residual contaminant removal where surface and shallow soil impacts exist. Soil excavation typically involves the use of standard earth-moving equipment such as tracked excavators and front-end loaders.

4.1.2 Capping

Capping is an effective containment technology, which controls hazards by eliminating routes of exposure and reducing contaminant migration via isolation and elimination of surface water infiltration. Capping typically involves engineered covers including placing clean fill, compacted clay, asphalt, or concrete over impacted soil.

4.1.3 Security Barriers

A security barrier is an effective technology, often used in conjunction with other remedial technologies, which restricts potential receptor access to impacted areas. Security barriers can include fences or walls that surround impacted areas.

4.1.4 Institutional Controls

Institutional controls are non-engineered instruments such as administrative and legal controls that can minimize potential human exposure to impacted soils. Typical institutional controls can include soil handling permits and deed recordation.

4.2 Groundwater

The Groundwater ICM is the existing groundwater remedial technology which has been successfully implemented at the Wichita Facility. The current Groundwater ICM consists of 14 interceptor wells; 12 wells extract groundwater from the S2/S3 aquifer and two wells extract groundwater from the S1 (deep) aquifer. The locations of the wells are presented on **Figure 5**. The interceptor/extraction wells operate to maintain cones of depression within the aquifers to prevent migration of dissolved contaminants from the subsurface and to contain impacted groundwater to prevent migration. Groundwater elevation contour maps and isoconcentration contour maps based upon the June 2015 semi-annual groundwater event [18] for the S1 and S2/S3 sand layers have been produced (**see Figures 9-20**). The Groundwater ICM will be evaluated as a final corrective measure alternative during the CMS (**Table 2**) by completing an effectiveness evaluation in accordance with the U.S. EPA guidance document, *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems* (January 2008 [19]). The results of the effectiveness evaluation will be presented in the CMS Report.

4.3 Soil Vapor

A soil vapor ICM has been installed for the Administration, Control Laboratory, and Technical Center Buildings (**Figure 6**) to minimize the potential for building occupants to be exposed to chemicals present or potentially present in soil gas beneath the building. A building survey will be completed, and the results submitted to the U.S. EPA separately. If the building survey indicates potentially complete exposure pathways, then a separate CMS will be developed (**Figure 2**). Therefore, remedial technologies associated with VI will not be evaluated in this CMS.

4.4 DNAPL

The DNAPL source areas at the Site are associated with historical waste disposal practices. The chemical makeup and areal extent of DNAPL within the Site have been determined [5,6,7]. DNAPL was observed extending through the saturated zone in four areas at the Site: Eastern Hex Area, Northwestern Hex Area, Landfill Hex Area, and CT and Perc Area. The primary compounds that occur with DNAPL at the Site are carbon tetrachloride chloroform, perchloroethene, pentachlorphenol, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, and benzene hexachloride. **Figures 21-25** present the areas which exhibit indications of DNAPL. The landfill ICM was designed and constructed to contain the wastes in place (e.g. Alpha Cake). The dissolved phase concentrations originating from the identified DNAPL sources are addressed on an ongoing basis by the Groundwater ICM. A pilot study to evaluate DNAPL mobility and potential recoverability at the Site will be performed during the CMS; the pilot study work plan is presented in **Appendix A**. The CMS will incorporate the information obtained during the DNAPL pilot study to screen potential applicable technologies, including but not limited to,hydraulic containment, recovery and institutional controls. These technologies will be evaluated for DNAPL in the CMS (**Figure 2 and Table 2**) and they are summarized below. In addition, potential application of DNAPL treatment technologies may have limited implementability for the site, however they will be considered in the CMS technology screening process as outlined in Section 4.5.

4.4.1 Hydraulic Containment

Hydraulic containment is an effective means of source and residual contaminant control and removal. Hydraulic containment can involve the use of groundwater extraction wells equipped with pumps to control the groundwater gradient (such as the Groundwater ICM at the Site).

4.4.2 Recovery

Recovery is a method for collecting flowable and residual material. Recovery typically involves installation of horizontal or vertical collection wells within the flowable material or at the edge of the residual material; the material is then pumped to the surface for disposal. In order to further evaluate source removal consistent with Section C.8.a. of the Permit, GSH will consider enhancements to recovery alternatives, including the use of solvents to enhance mobility.

4.4.3 Institutional Controls

Institutional controls are non-engineered instruments such as administrative and legal controls that can minimize potential human exposure to impacted media. Typical institutional controls can include soil handling permits, deed restrictions and groundwater use prohibitions.

4.5 Remedial Technology Screening

Site characteristics and other information/data obtained during the RFI will be used to support the remedial technology screening for soil, the groundwater ICM evaluation, as well as the DNAPL mobility and recoverability pilot study. The screening will evaluate the feasibility of existing remedial technologies and ICMs as it relates to site characteristics, specific contaminant types and concentrations, implementability, and past performance.

The implementability screening will encompass both the technical and administrative feasibility of implementing the technologies and ICMs listed above. The technical feasibility will assess the following:

- Information obtained during the RFI regarding contaminant types and concentrations
- Site characteristics
- The ability to obtain necessary permitting
- The availability of treatment, storage or disposal facilities for remediation-derived wastes
- The availability of necessary equipment

The effectiveness screening will consider the ability of each technology to meet the CMS objectives and consider the potential impacts to human health and the environment during the construction or implementation of the technology as well as potential long-term impacts (during and after the remedial action is complete). The effectiveness screening will consider the ability of each technology to effectively decrease the inherent threats or risks associated with the COC, while minimizing or preventing the generation of treatment residuals that could be harmful to human health or the environment.

The reliability screening will consider the ability of each technology to treat the contaminants at the Site, based on proven success at this Site.

The evaluation of relative cost will be removed from the technology screening process. However, more detailed cost analyses, as described in **Section 4.7.5** will be conducted as part of the corrective measures alternatives evaluation and will be one of the factors considered during remedy selection.

4.6 Corrective Measures Alternatives Identification

Existing remedial technologies and ICMs will be evaluated for soil, groundwater and DNAPL as corrective measures alternatives to meet the CMS objectives. The following sections outline the criteria that will be used for the corrective measures alternatives evaluation.

4.7 Evaluation Criteria

The corrective measures alternatives will be evaluated to determine their ability to achieve the CMS objectives outlined in **Section 3** and compared to the balancing criteria outlined in the Permit [1]. A brief discussion of the balancing criteria evaluation is presented below.

4.7.1 Long-Term Reliability and Effectiveness

To establish the degree of certainty that the remedy will prove successful, each corrective measure alternative will be evaluated to assess the following factors over a 30-year timeframe:

- Magnitude of residual risks
- Type and degree of long-term management required
- Exposure potential of humans and environmental receptors to remaining wastes
- Long-term reliability of the engineering and institutional controls
- Potential need for replacement of the remedy

4.7.2 Reduction of Toxicity, Mobility, and Volume

To assess the degree to which each corrective measure alternative will reduce toxicity, mobility, or volume of hazardous wastes (including hazardous constituents) that would be destroyed or treated at the Site, the following factors will be considered:

- The treatment processes the remedy(ies) employs and materials it would treat
- Amount of hazardous wastes (including hazardous constituents) that would be destroyed or treated
- The degree to which the treatment is irreversible
- The residuals that will remain following treatment while considering the persistence, toxicity, mobility and propensity of hazardous constituents to bio-accumulate

4.7.3 Short-Term Effectiveness

To assess the short-term effectiveness of each corrective measure alternative, the following factors will be considered:

- Magnitude of reduction of existing risks
- Short-term risks that might be posed to the community, workers, or the environment during implementation of the remedy; including potential threats to human health and the environment associated with excavation, transportation, re-disposal, or containment
- Time until full protection is achieved

4.7.4 Implementability

The ease or difficulty of implementing each corrective measures alternative will be assessed by considering the following types of factors:

- Degree of difficulty associated with constructing the technology
- Expected operational reliability of the technologies
- Need to coordinate/obtain necessary approvals and permits from other agencies
- Availability of necessary equipment and specialties
- Available capacity and location of needed treatment, storage and disposal services

4.7.5 Cost

Cost estimates, where applicable, will include the following:

- Engineering and planning
- Construction
- Health and safety measures
- Permitting
- Operation and Maintenance

4.8 Remedy Selection Process

The selected corrective measure alternatives will be based on the ability of the recommended alternative to achieve the CAOs, with the remaining evaluation criteria balanced to provide the most effective overall alternative while considering reliability, performance, implementability, safety, environmental protection, and cost effectiveness.

5. Data and Information Sources

The currently available RFI and literature data, ongoing monitoring information, and proposed supplemental CMS activities will be adequate to conduct the corrective measure alternatives evaluation and select the proposed soil, groundwater and DNAPL remedies at the Site.

6. CMS Report Outline

At the completion of the CMS activities, the findings and conclusions of the study will be summarized in a CMS Report. The CMS report outline will be consistent with Part II C.8.b(6) of the Permit and will include the following:

- Introduction/Purpose
- Description of Current Conditions
- Media Cleanup Standards
- Identification, Screening, and Development of Corrective Measures Alternatives
- Evaluation of a Final Corrective Measure Alternative
- Recommendation for a Final Corrective Measure Alternative
- Public Involvement Plan

7. CMS Schedule

The proposed schedule to complete the CMS at the OCC Facility is included as **Figure 26**. The CMS activities will be conducted in a manner that will facilitate the submittal of the CMS Report to U.S. EPA and KDHE in accordance with the Permit Schedule of Work.

8. References

[1] Kansas Department of Health and Environment and U.S. Environmental Protection Agency. 2007. Hazardous Waste Management Facility Permit, Occidental Chemical Corporation, 6200 South Ridge Road, Wichita, Kansas.

[2] U.S. Environmental Protection Agency. May 1994. *RCRA Corrective Action Plan.* EPA/EC-G-2002-100, OSWER Directive 9902.3-2A.

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[5] Conestoga-Rovers & Associates, Inc. December 2014. Comprehensive RCRA Facility Investigation Summary Report, Glenn Springs Holdings, Inc., Occidental Chemical Corporation Facility, Wichita, Kansas.

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[8] GHD Services, Inc. August 2015. Human Health Risk Assessment, Glenn Springs Holdings, Inc., Occidental Chemical Corporation Facility, Wichita, Kansas.

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[15] Weston Solutions Inc. August 2008. Interim Corrective Measures Implementation Report for Asbestos Surface Impoundment SWMU, Occidental Chemical Corporation, Wichita, Kansas.

[16] Environmental Resources Management. December 2010. Comprehensive Voluntary Cleanup Investigation Report, Arkema, Inc.-Wichita, Kansas Plant.

[17] Kansas Department of Health and Environment. September 2014. Site Inspection: De Bruce Grain, Wichita, Kansas.

[18] GHD Services, Inc. July 2015. Semi-Annual Groundwater Monitoring Report, Glenn Springs Holdings, Inc., Occidental Chemical Corporation Facility, Wichita, Kansas.

[19] U.S. Environmental Protection Agency. January 2008. *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems.* EPA-600-R-08-03.

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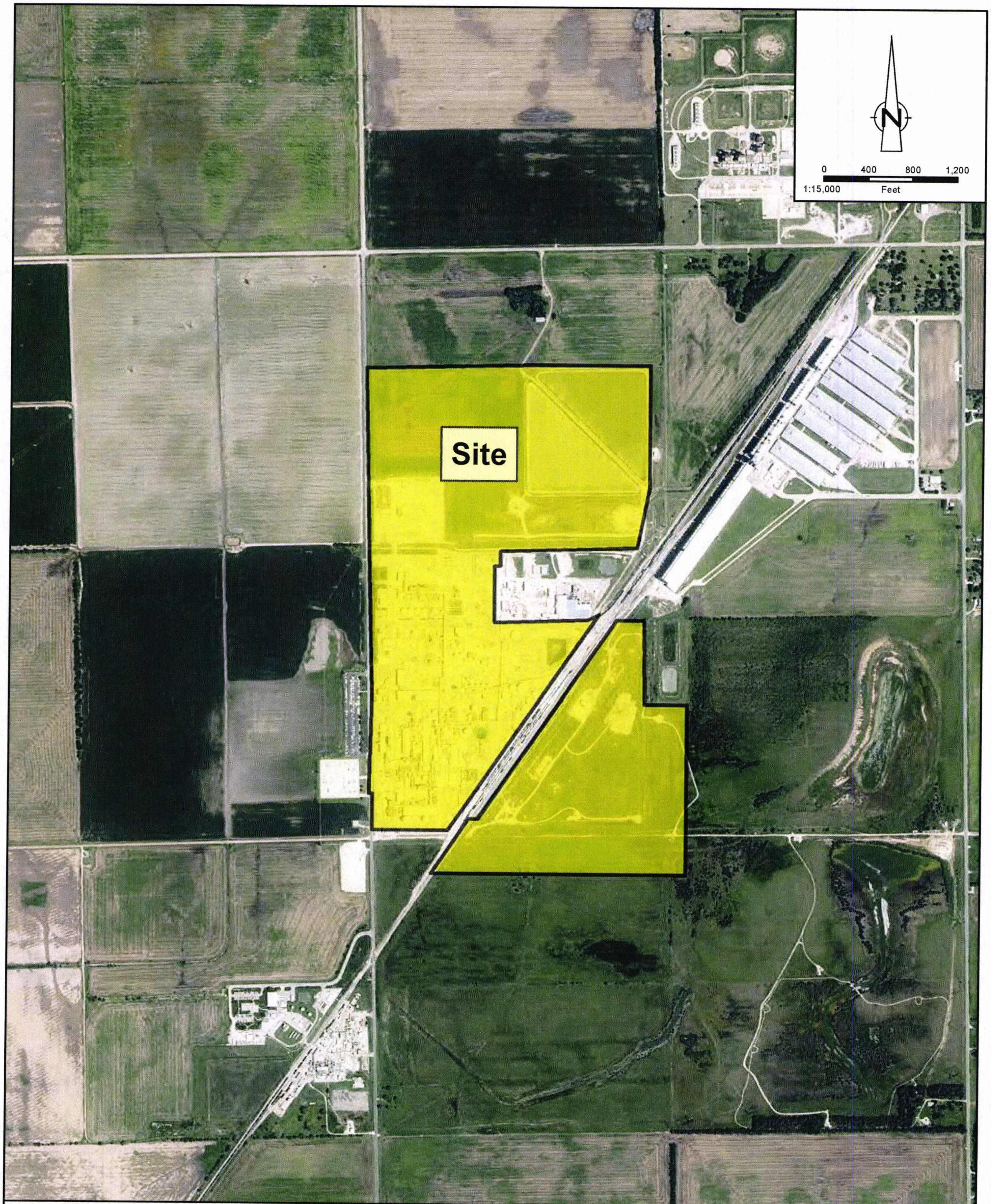
Figures



Source: NAIP Imagery of Kansas, 2014 – U.S. Department of Agriculture (USDA) Farm Service Agency, Aerial Photography Field Office.
Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

figure 1

SITE LOCATION
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

GHD

054046-D22113(046)GIS-OT001 Aug 26/2015

Wichita CMS Alignment
With RCRA FIRST Remedy Selection Process

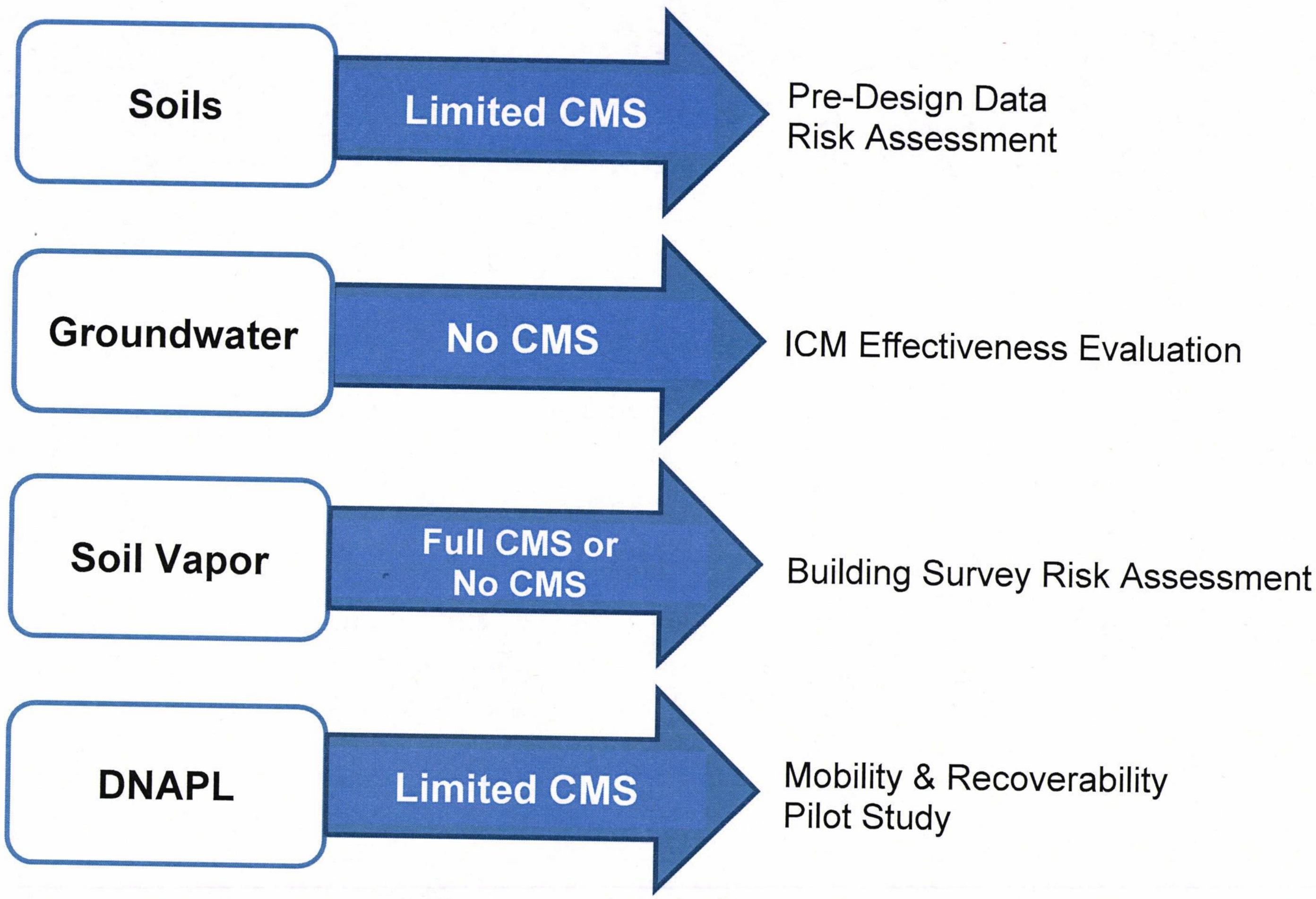


figure 2

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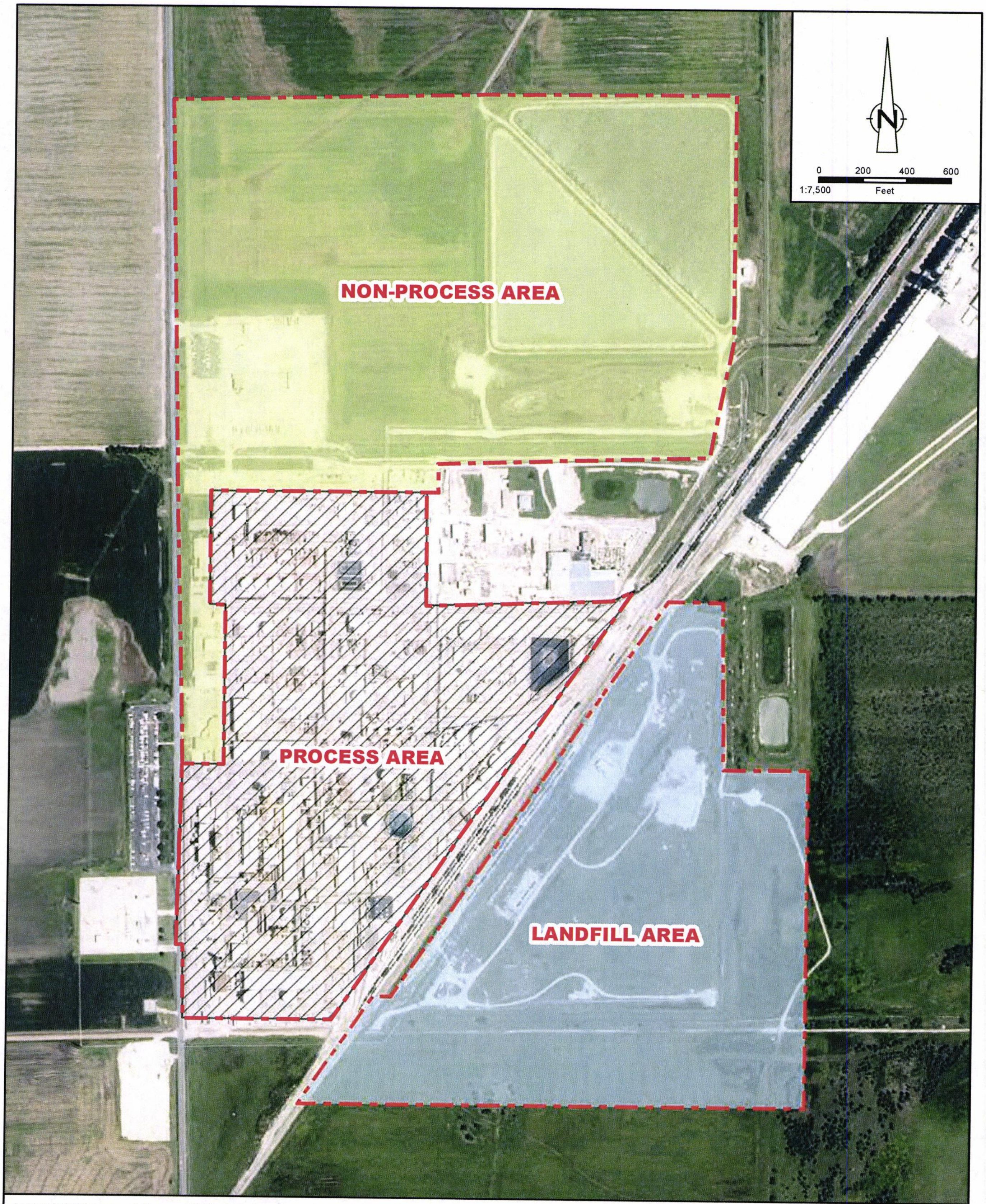


Source: NAIP Imagery of Kansas, 2014 – U.S. Department of Agriculture (USDA) Farm Service Agency, Aerial Photography Field Office.
Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

- Landfill Area
- Non-Process Area
- Process Area

figure 3

FACILITY LAYOUT
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046-D22113(046)GIS-OT002 Aug 27/2015

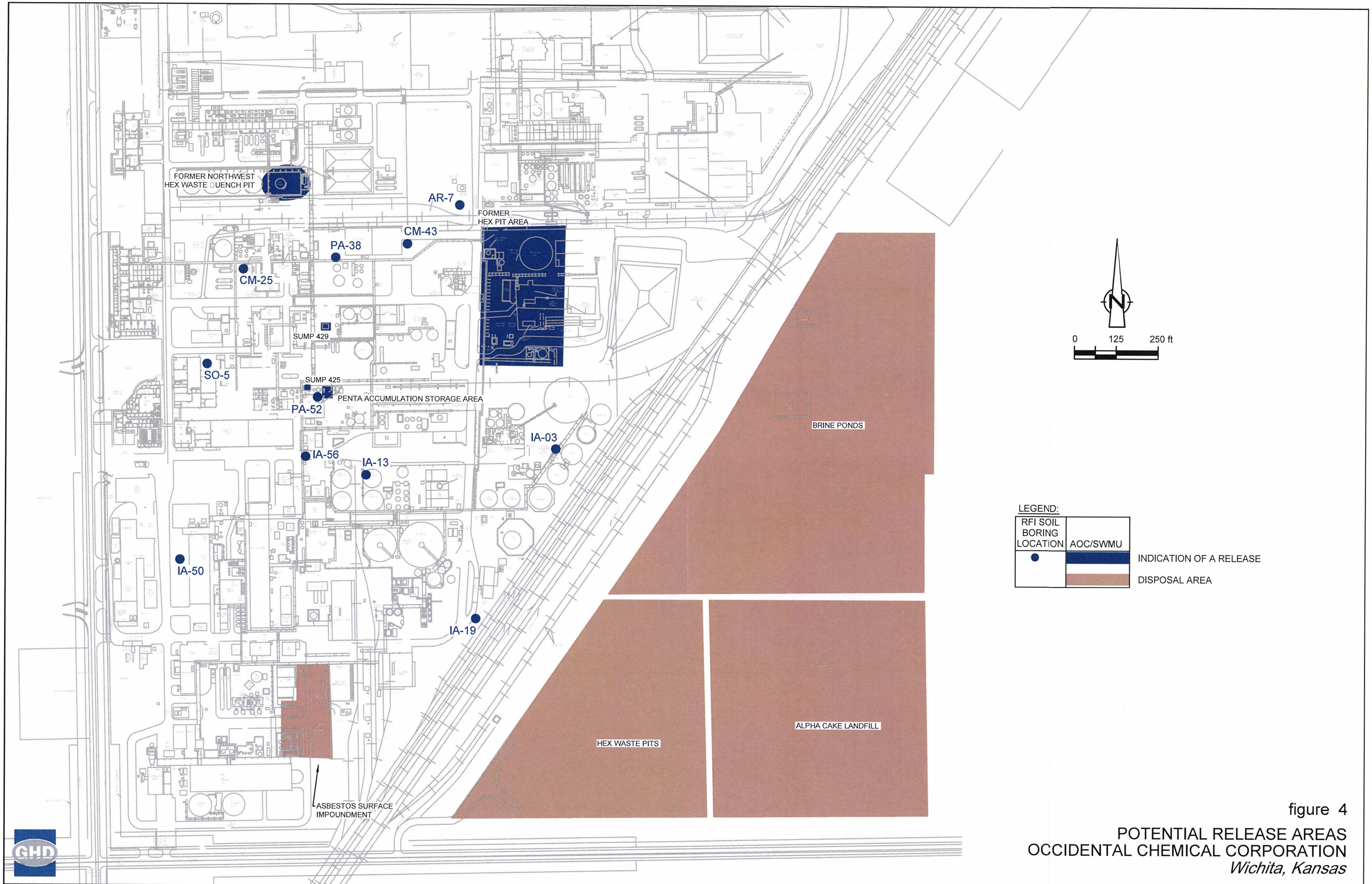
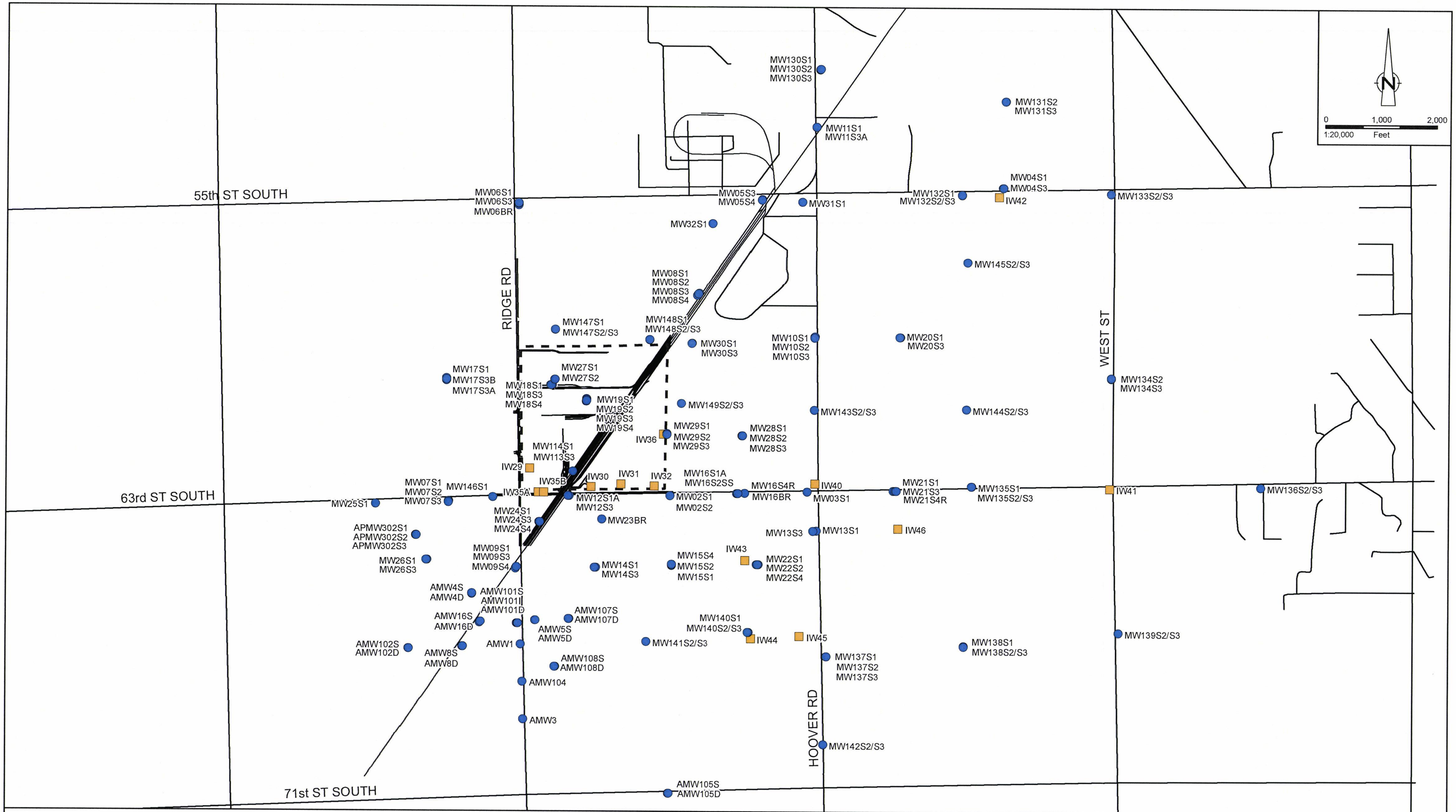


figure 4

POTENTIAL RELEASE AREAS
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

54046-D22113(046)GN-CO001 AUG 27/2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

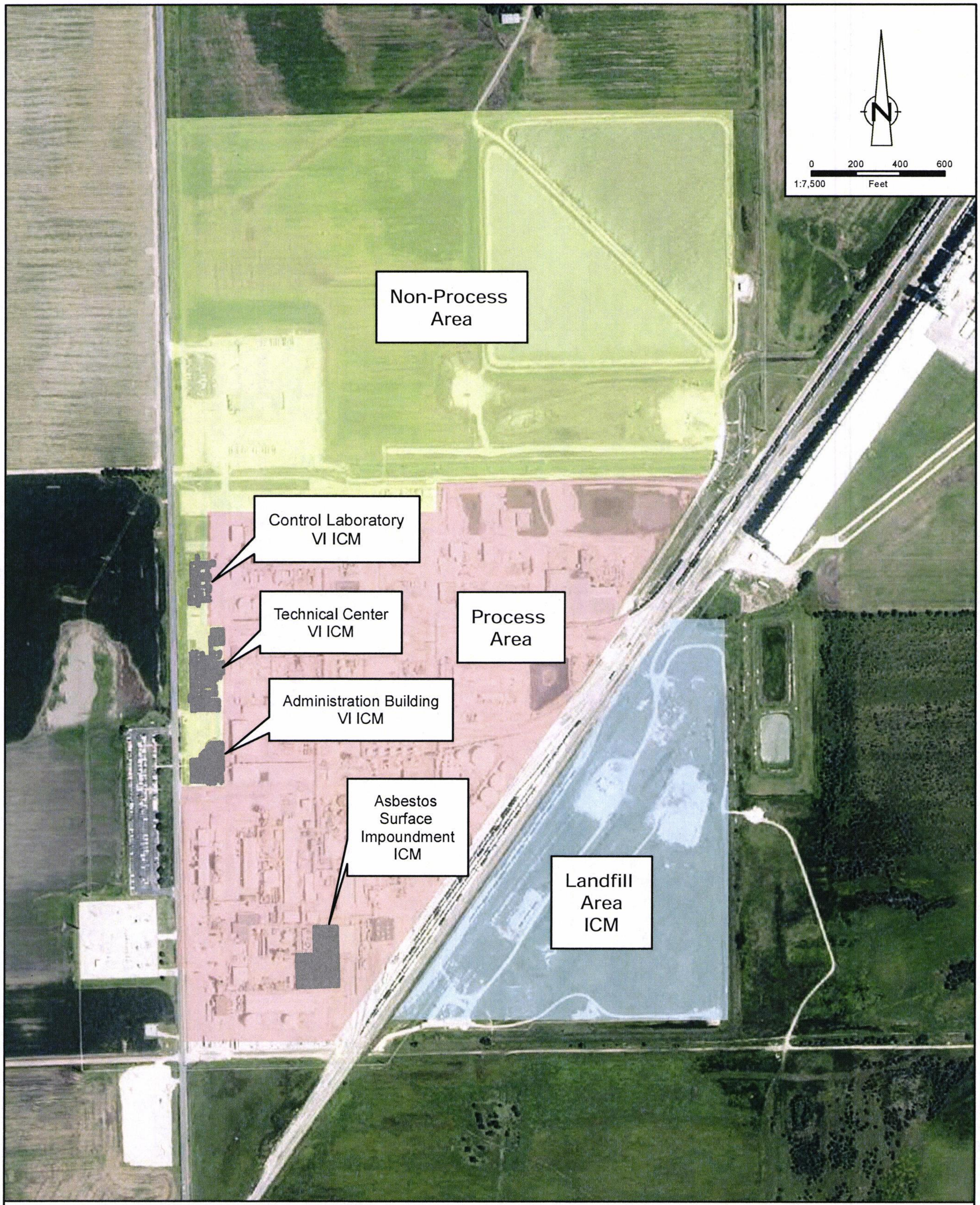
- Interceptor Well
- Monitoring Well
- Approximate Site Boundary
- Roads
- Railroad

GHD

figure 5

MONITORING AND INTERCEPTOR WELL LOCATIONS
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046-D22113(046)GIS-OT003 August 27, 2015

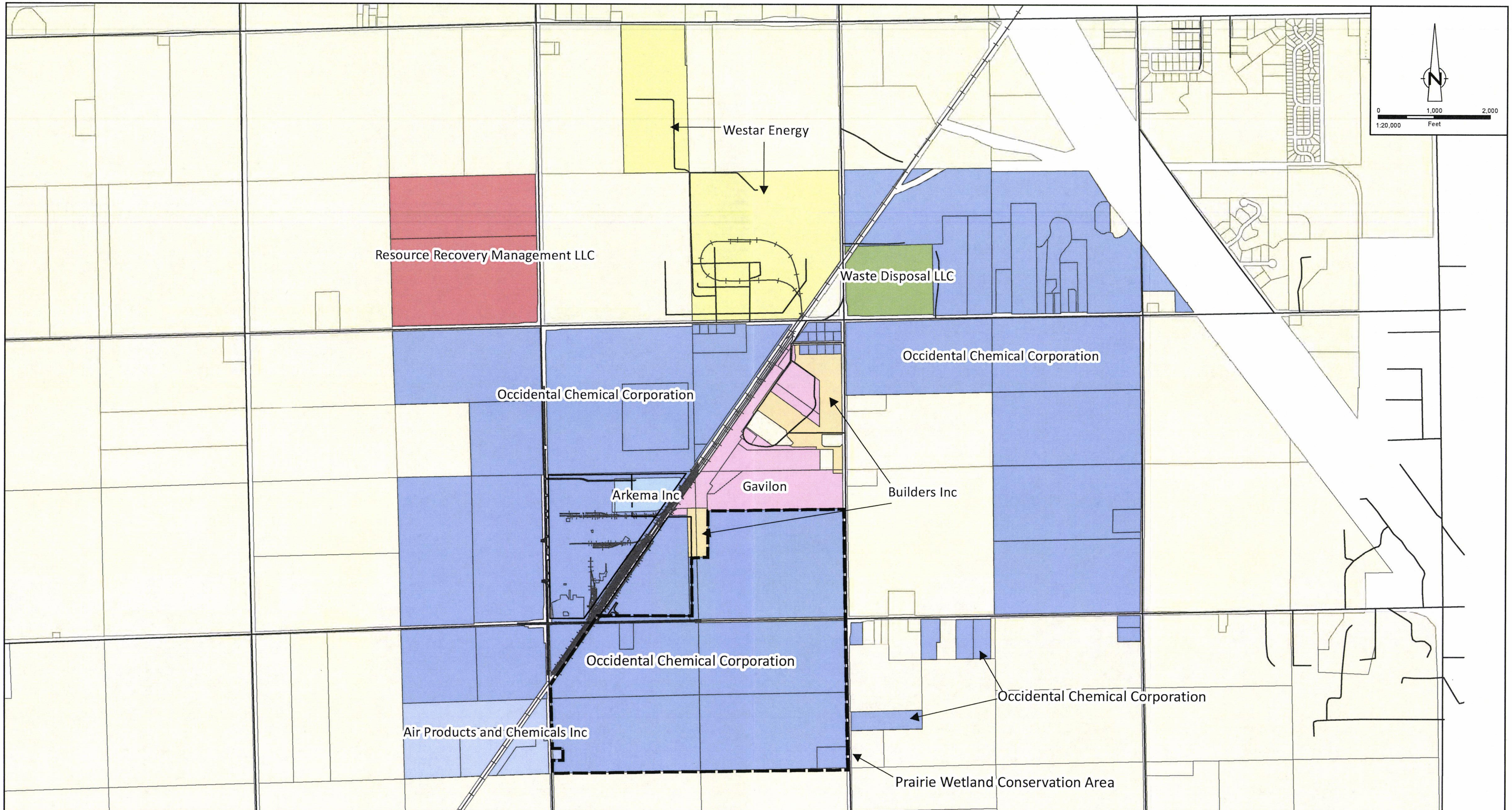


Source: NAIP Imagery of Kansas, 2014 – U.S. Department of Agriculture (USDA) Farm Service Agency, Aerial Photography Field Office.
Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

figure 6

SOIL AND VAPOR ICM LOCATIONS
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046-D22113(046)GIS-OT004 Aug 31/2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

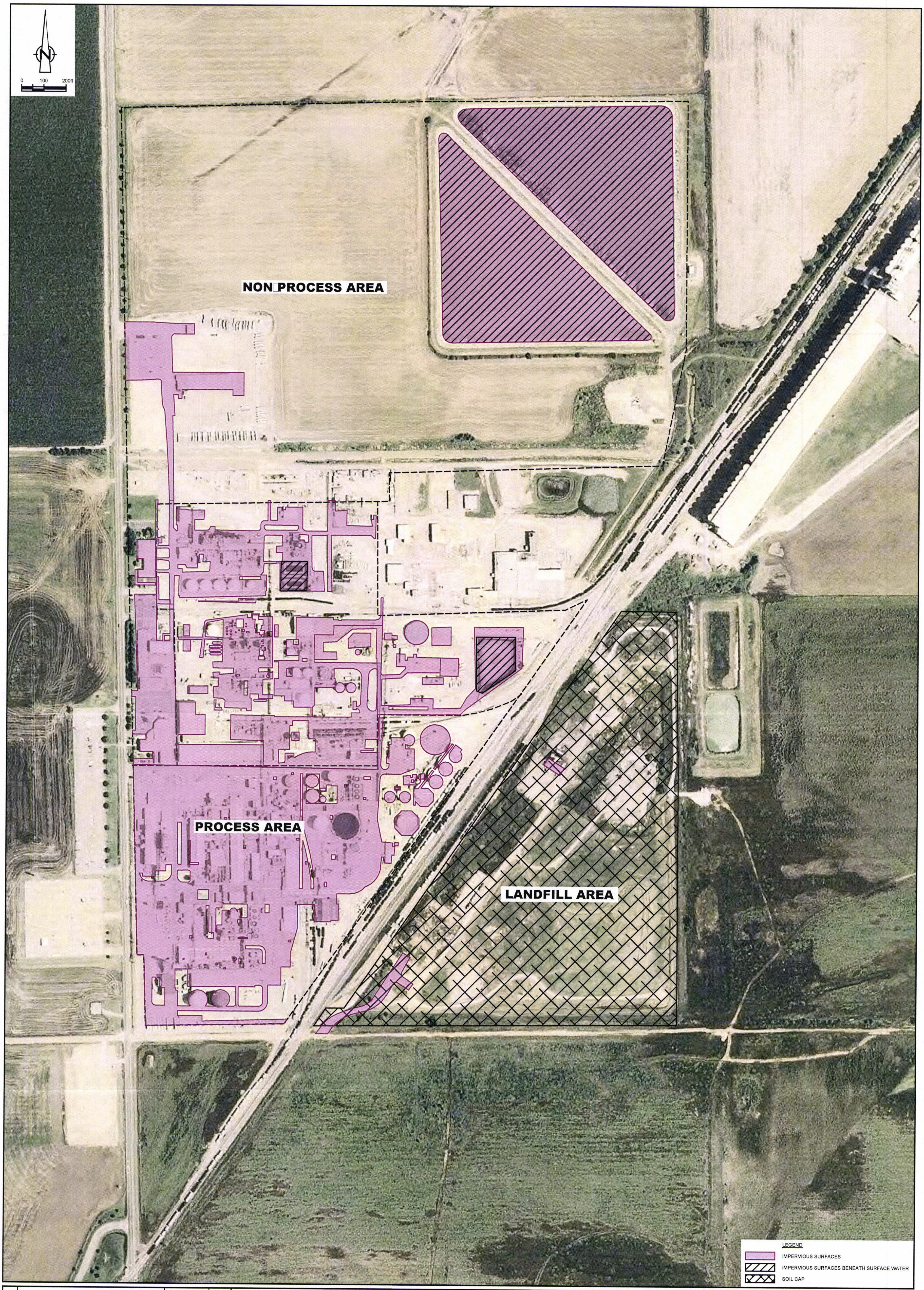
- Air Products and Chemicals Inc
- Arkema Inc
- Builders Inc
- Gavilon
- Occidental Petroleum Corporation
- Resource Recovery Management LLC
- Waste Disposal LLC
- Westar Energy
- Prairie Wetland Conservation Area (PWCA or Nature Center)

GHD

figure 7

PROPERTY OWNERSHIP
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO001 August 27, 2015



No	Revision	Date	Initial

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

OCCIDENTIAL CHEMICAL CORPORATION
WICHITA, KANSAS

OCCIDENTIAL CHEMICAL CORPORATION

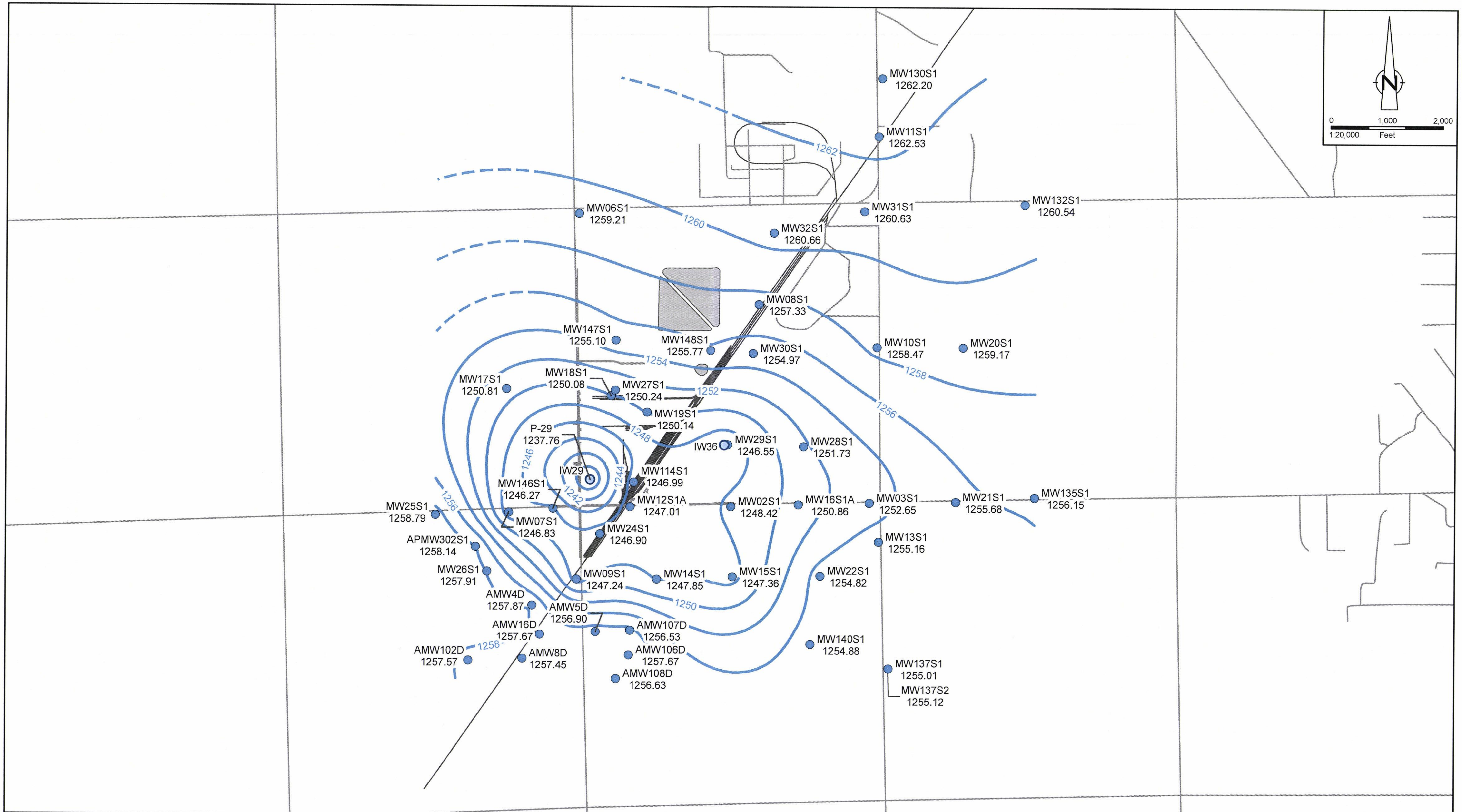
IMPERVIOUS COVER AND SOIL CAP AREAS

GHD

Source Reference:

Project Manager:	Reviewed By:	Date:	
B. CLEGG	D. SOUTTER	10/23/14	
Scale:	Project No.:	Report No.:	Drawing No.:
1:200	54046-D22113	046	figure 8

54046-D22113(046)GN-CO007 AUG 27/2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

GHD

- Roads
- Railroad
- Storm Ponds
- Interceptor Well Locations
- Sand Unit 1 Locations
- S1 Contours

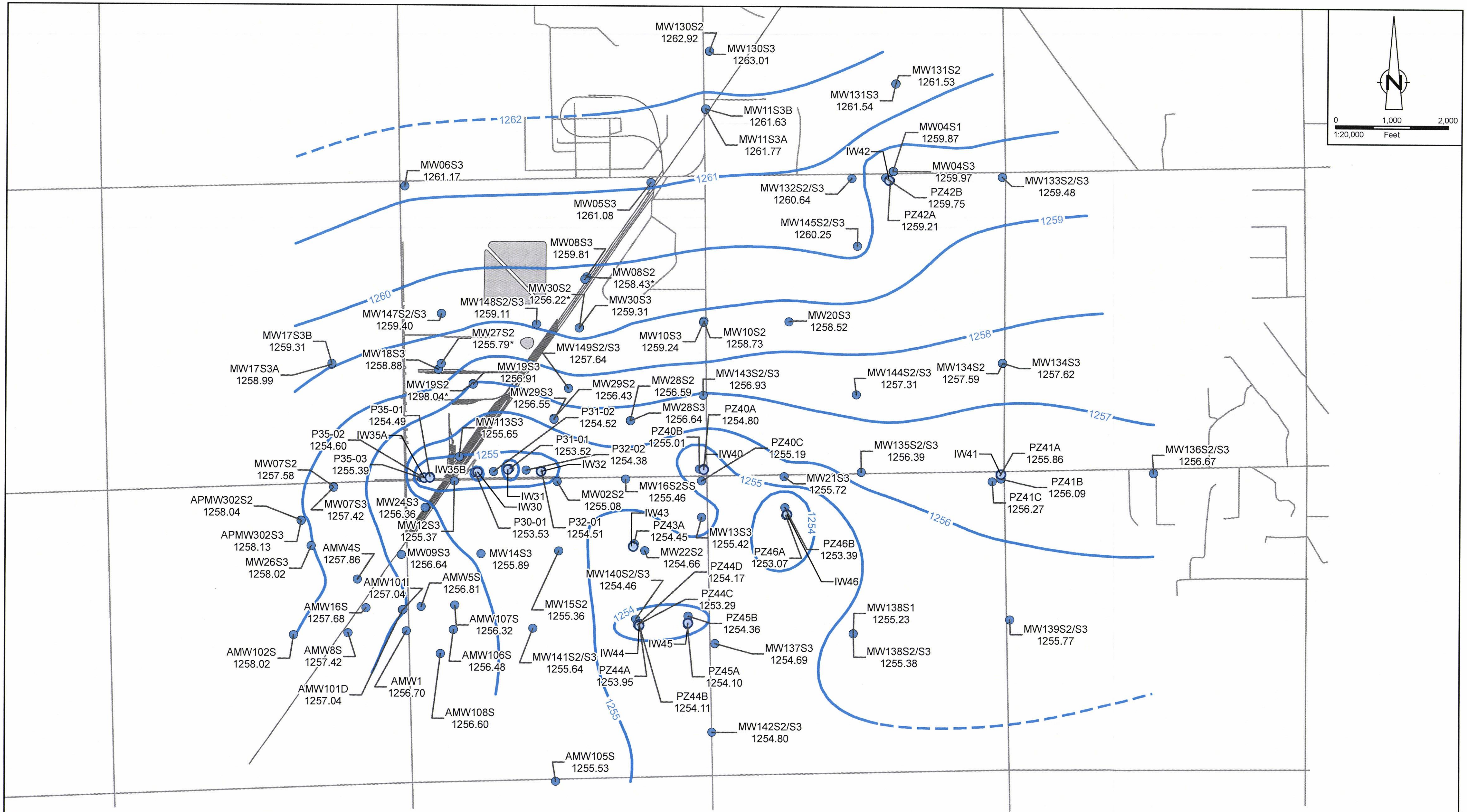
ID
WATER LEVEL (ft MSL)

Interceptor wells not used for contours

figure 9

JUNE 2015 GROUNDWATER CONTOURS - DEEP (S1) SCREENED SAND UNIT INTERVAL
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046-D22113(046)GIS-OT005 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

- Roads
- Railroad
- Storm Ponds
- Interceptor Well Locations
- Sand Unit 2/3 Locations
- S2/S3 Contours

ID
WATER LEVEL (ft MSL)

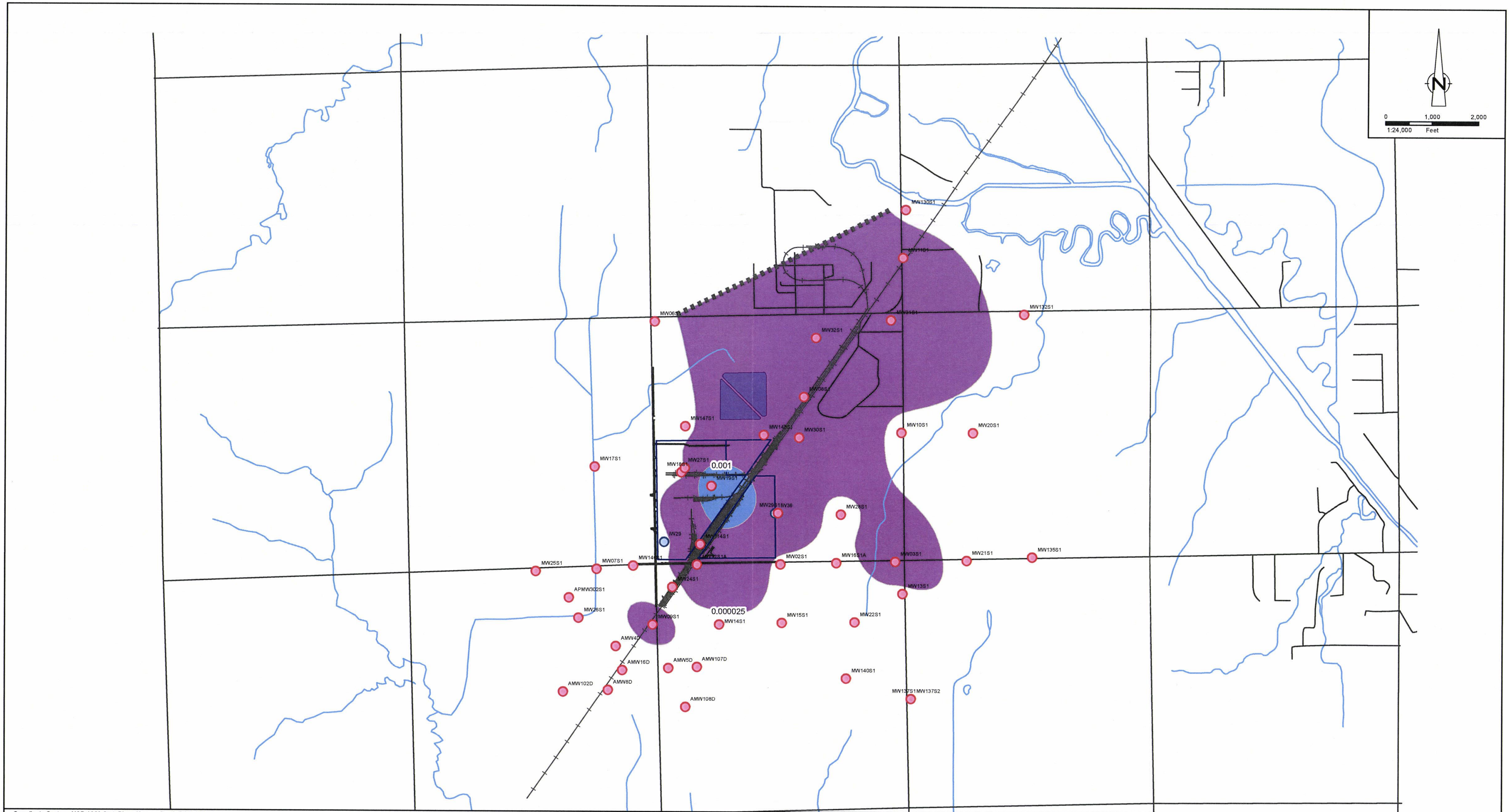
* - Water level not used in contouring
Interceptor wells not used for contours

GHD

figure 10

JUNE 2015 GROUNDWATER CONTOURS – INTERMEDIATE (S2/S3) SCREENED SAND UNIT INTERVAL
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046-D22113(046)GIS-OT006 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

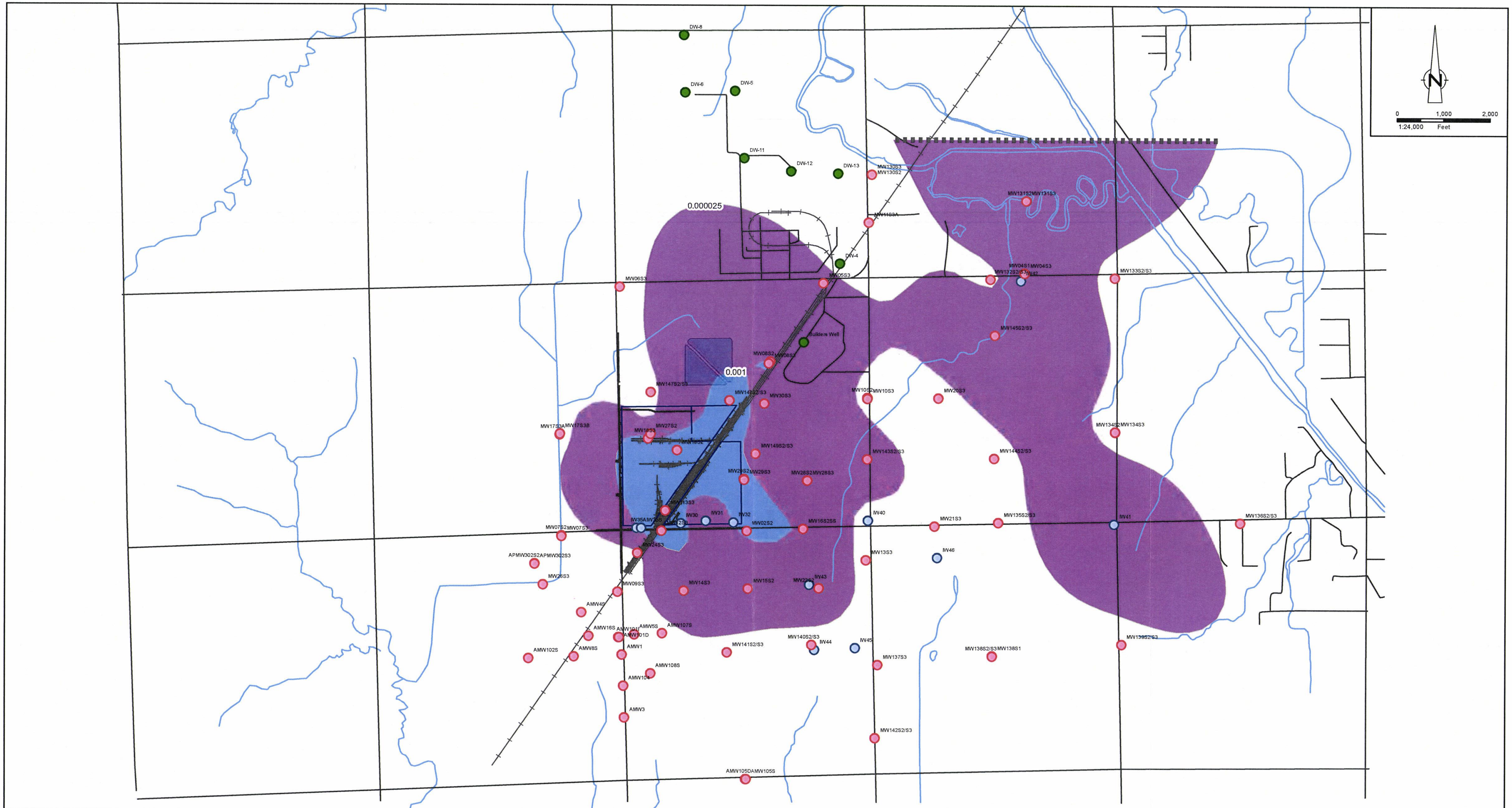
- 0.000025
- 0.001
- Interceptor Well
- Monitoring Well
- Limit Of Spatial Confidence

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S1 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 11

JUNE 2015 BETA-BHC ISOCONCENTRATION CONTOURS IN S1 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO002 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

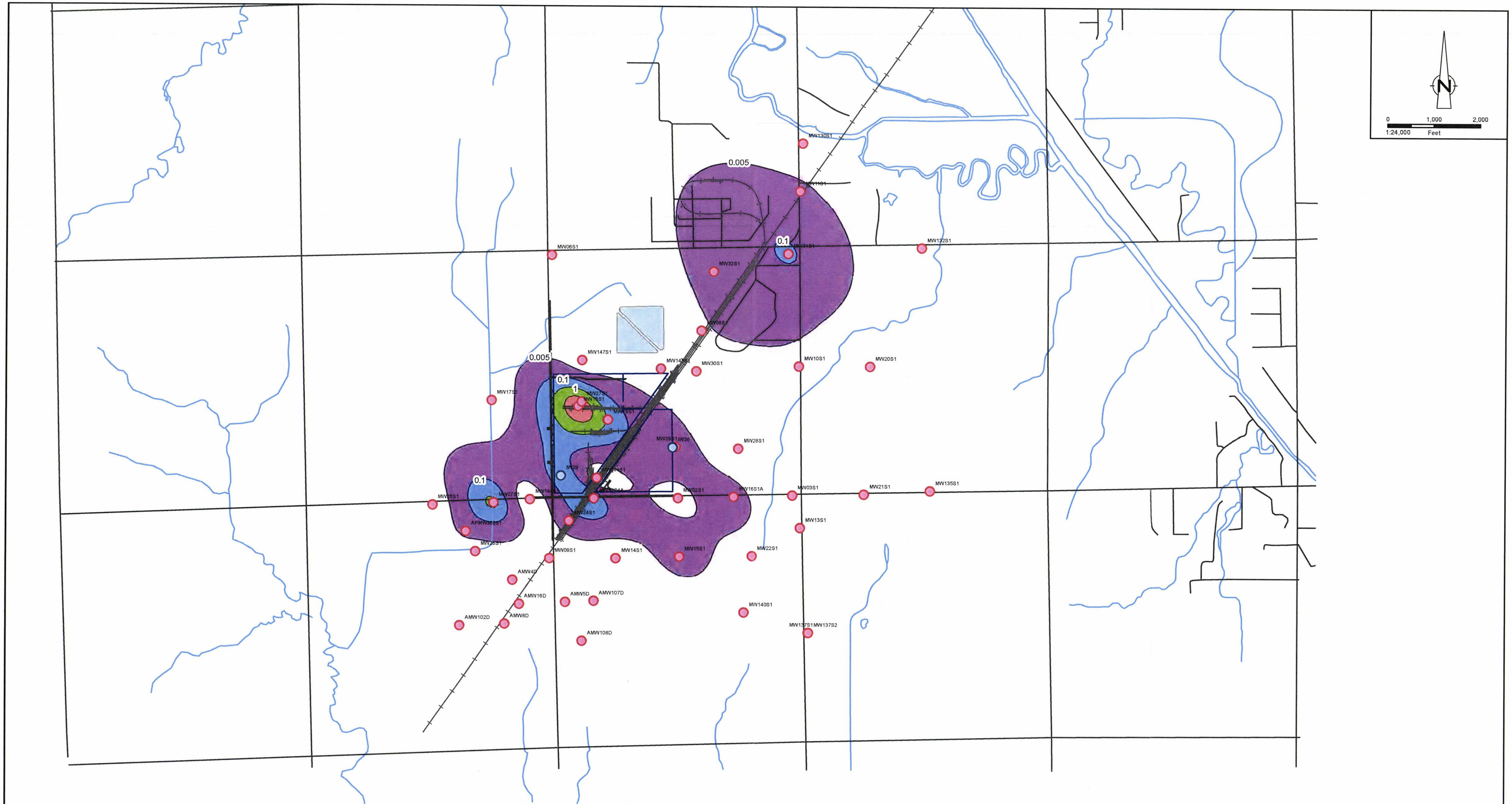
- 0.000025
- 0.001
- Interceptor Well
- Monitoring Well
- Production Well
- Limit Of Spatial Confidence

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S2/S3 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 12

JUNE 2015 BETA-BHC ISOCONCENTRATION CONTOURS IN S2/S3 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO003 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

- 0.005
- 0.1
- 1
- 7.93

- Interceptor Well
- Monitoring Well

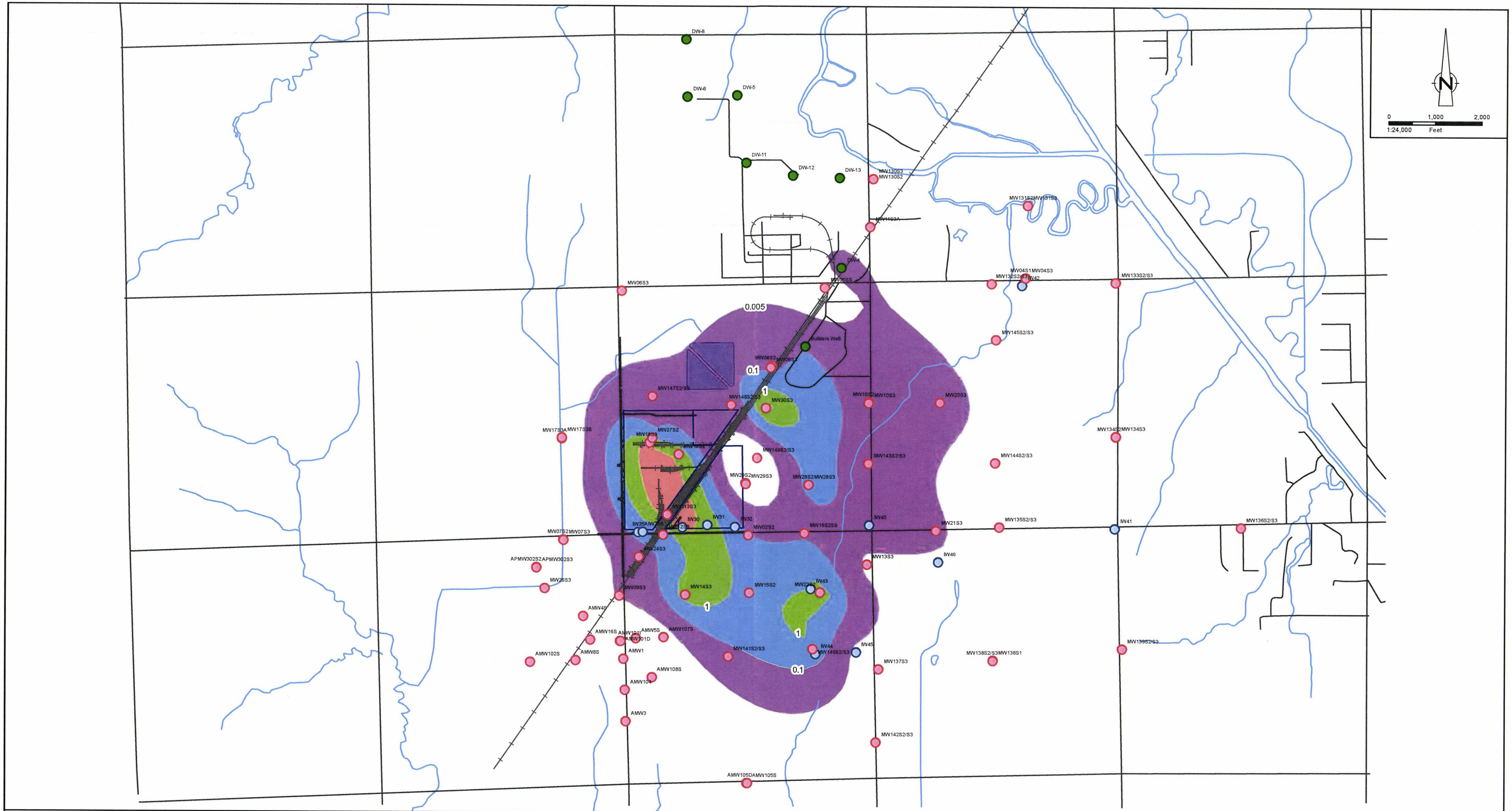
GHD

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S1 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 13

JUNE 2015 CARBON TETRACHLORIDE ISOCONCENTRATION CONTOURS IN S1 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO004 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

- 0.005
- 0.1
- 1
- 7.93

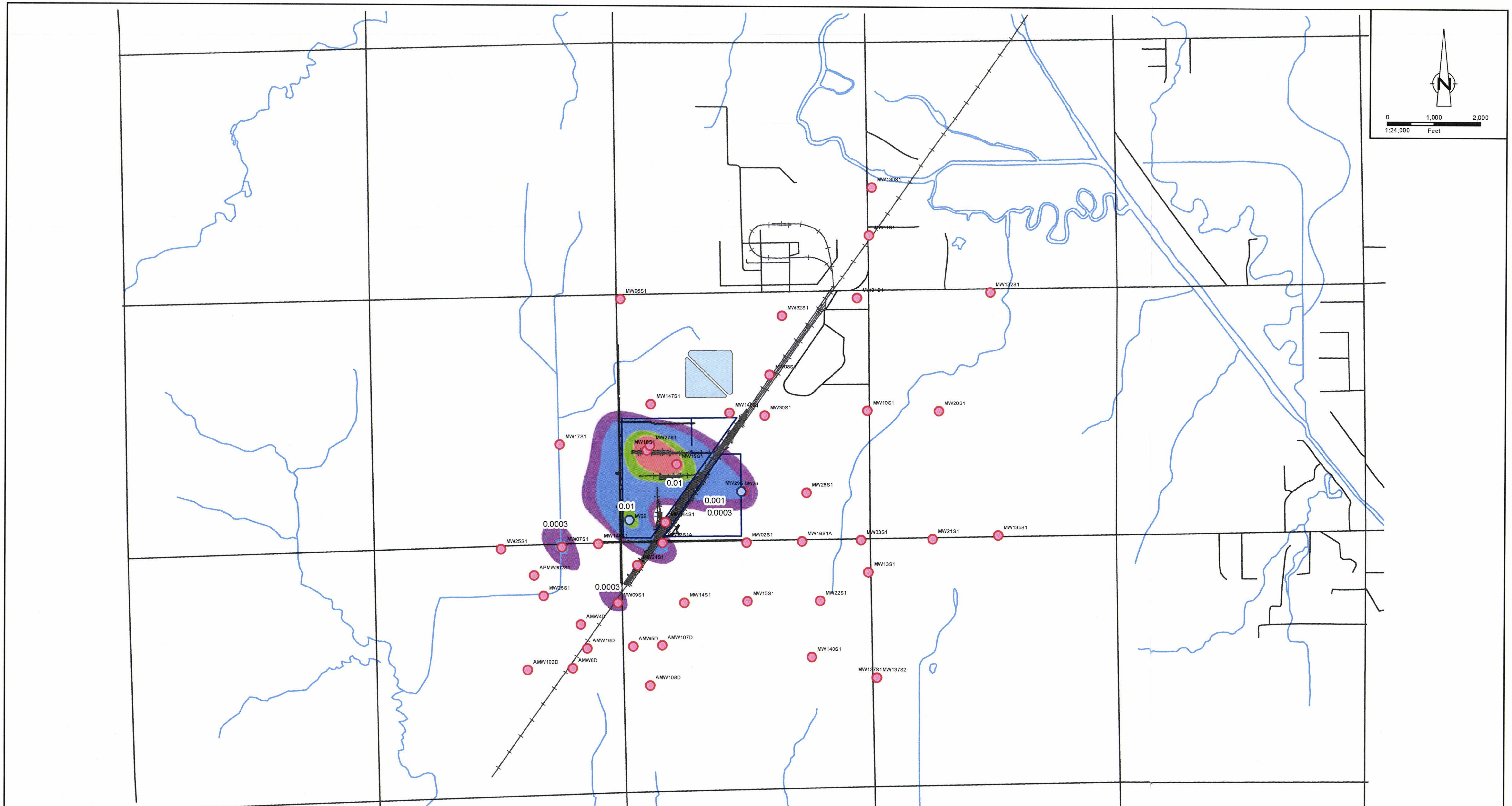
- Interceptor Well
- Monitoring Well
- Production Well

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S2/S3 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 14

JUNE 2015 CARBON TETRACHLORIDE ISOCONCENTRATION CONTOURS IN S2/S3 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO005 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

- 0.0003
- 0.001
- 0.01
- 0.032

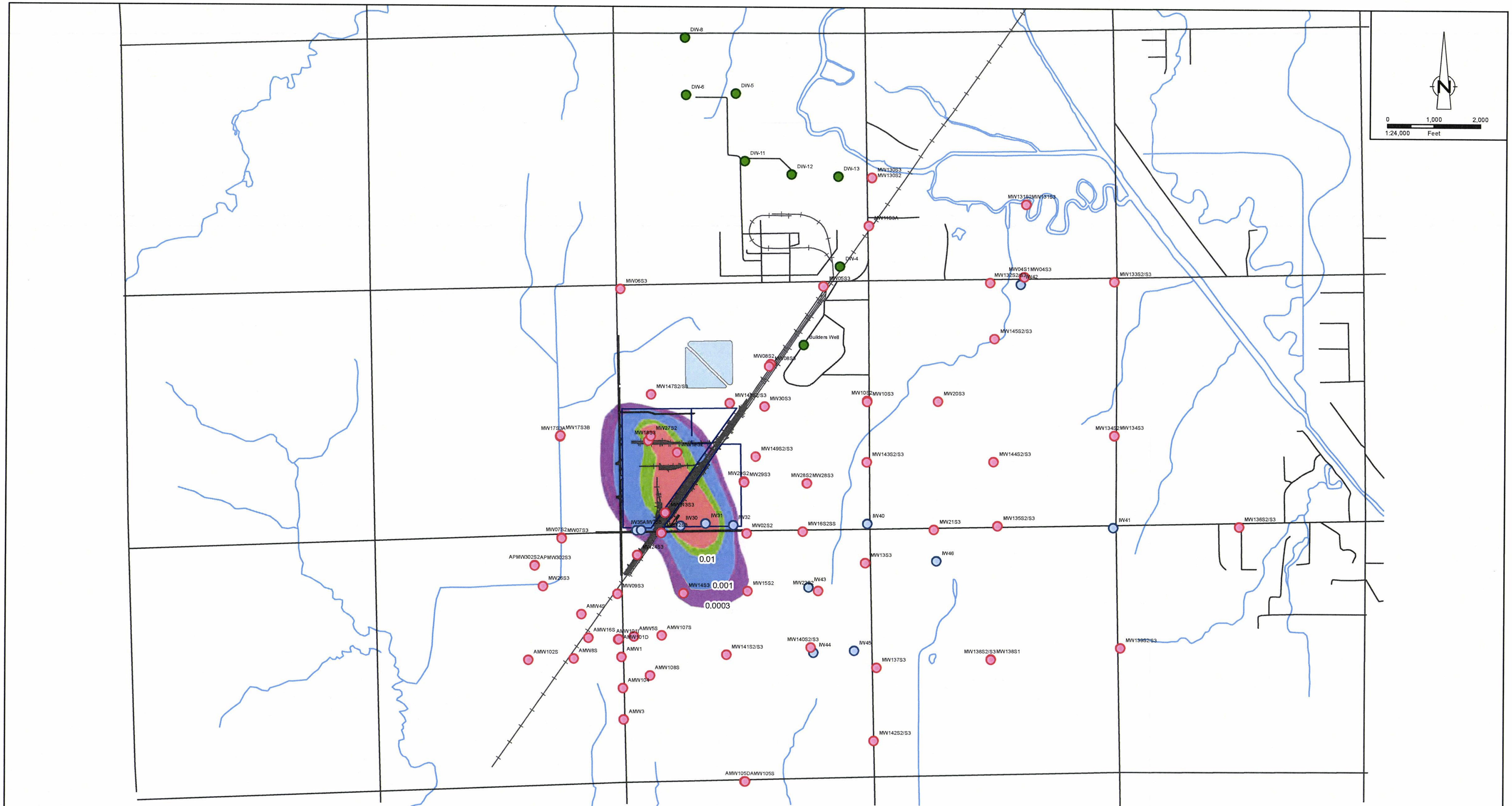
- Interceptor Well
- Monitoring Well

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S1 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 15

JUNE 2015 HEXACHLOROBUTADIENE ISOCONCENTRATION CONTOURS IN S1 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO006 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

- 0.0003
- 0.001
- 0.01
- 0.032

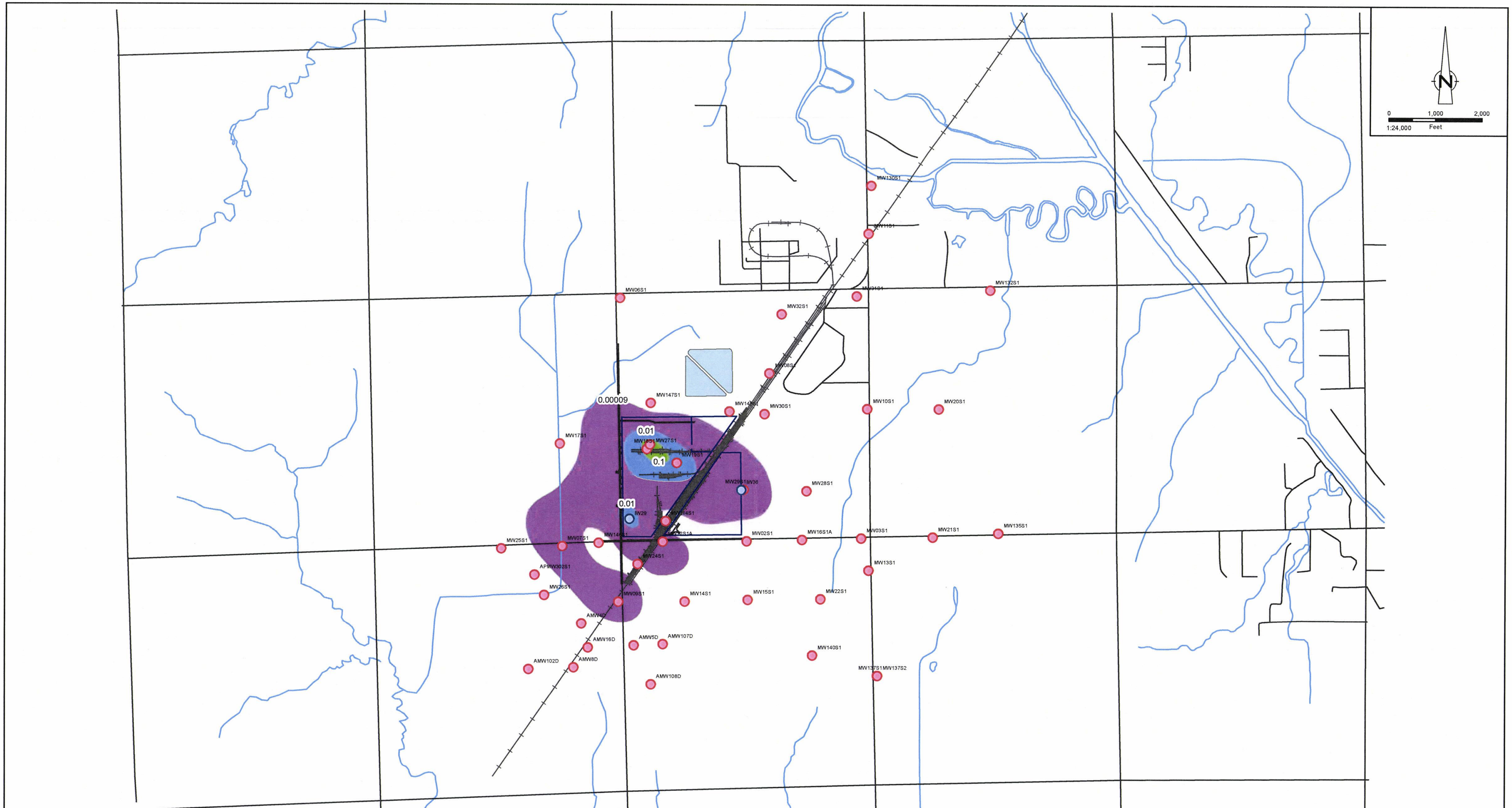
- Interceptor Well
- Monitoring Well
- Production Well

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S2/S3 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 16

JUNE 2015 HEXACHLOROBUTADIENE ISOCONCENTRATION CONTOURS IN S2/S3 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO007 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

- 0.00009
- 0.01
- 0.1
- 0.5

- Interceptor Well
- Monitoring Well

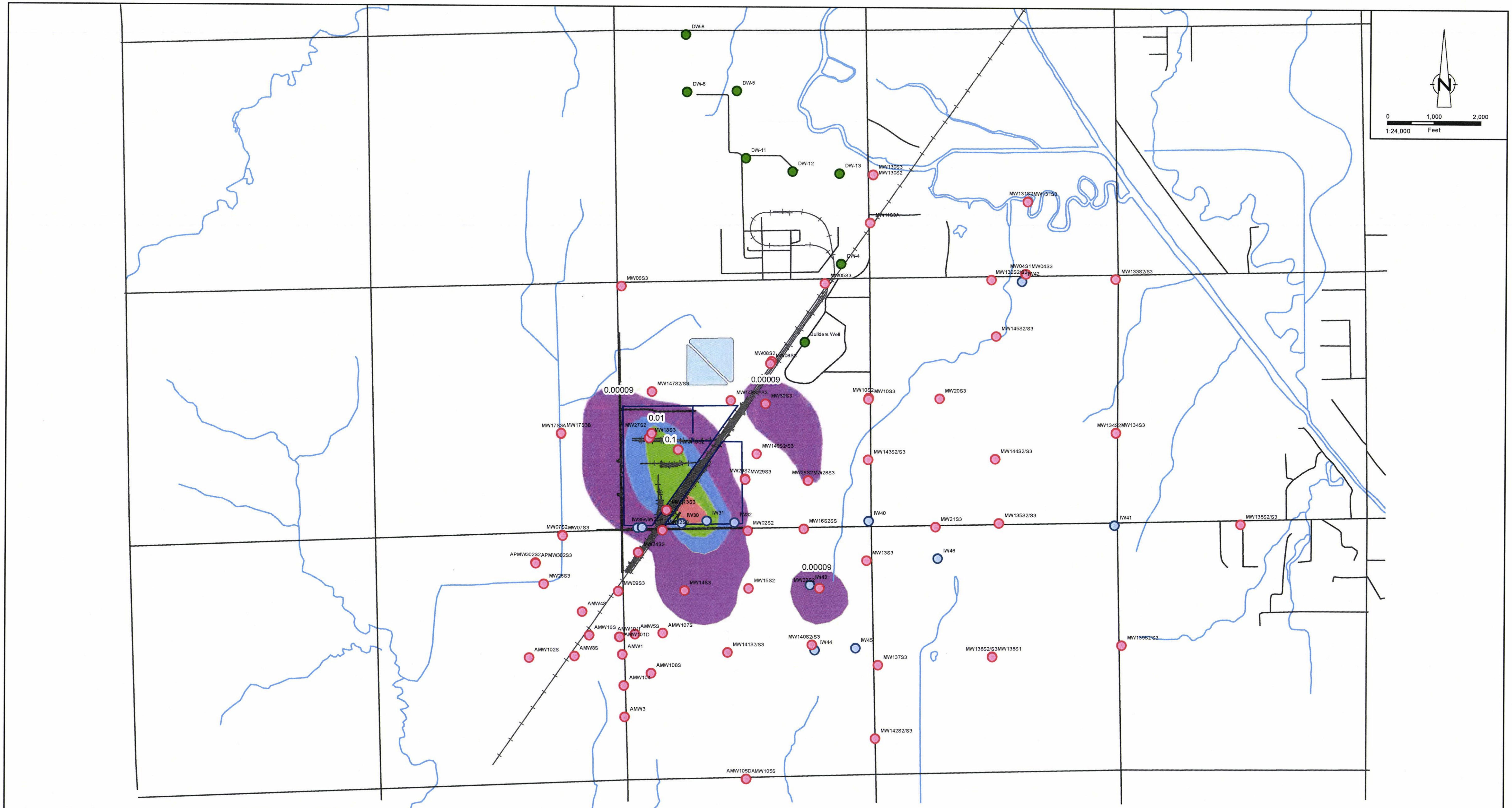
GHD

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S1 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 17

JUNE 2015 HEXACHLOROETHANE ISOCONCENTRATION CONTOURS IN S1 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO008 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

- 0.00009
- 0.01
- 0.1
- 0.5

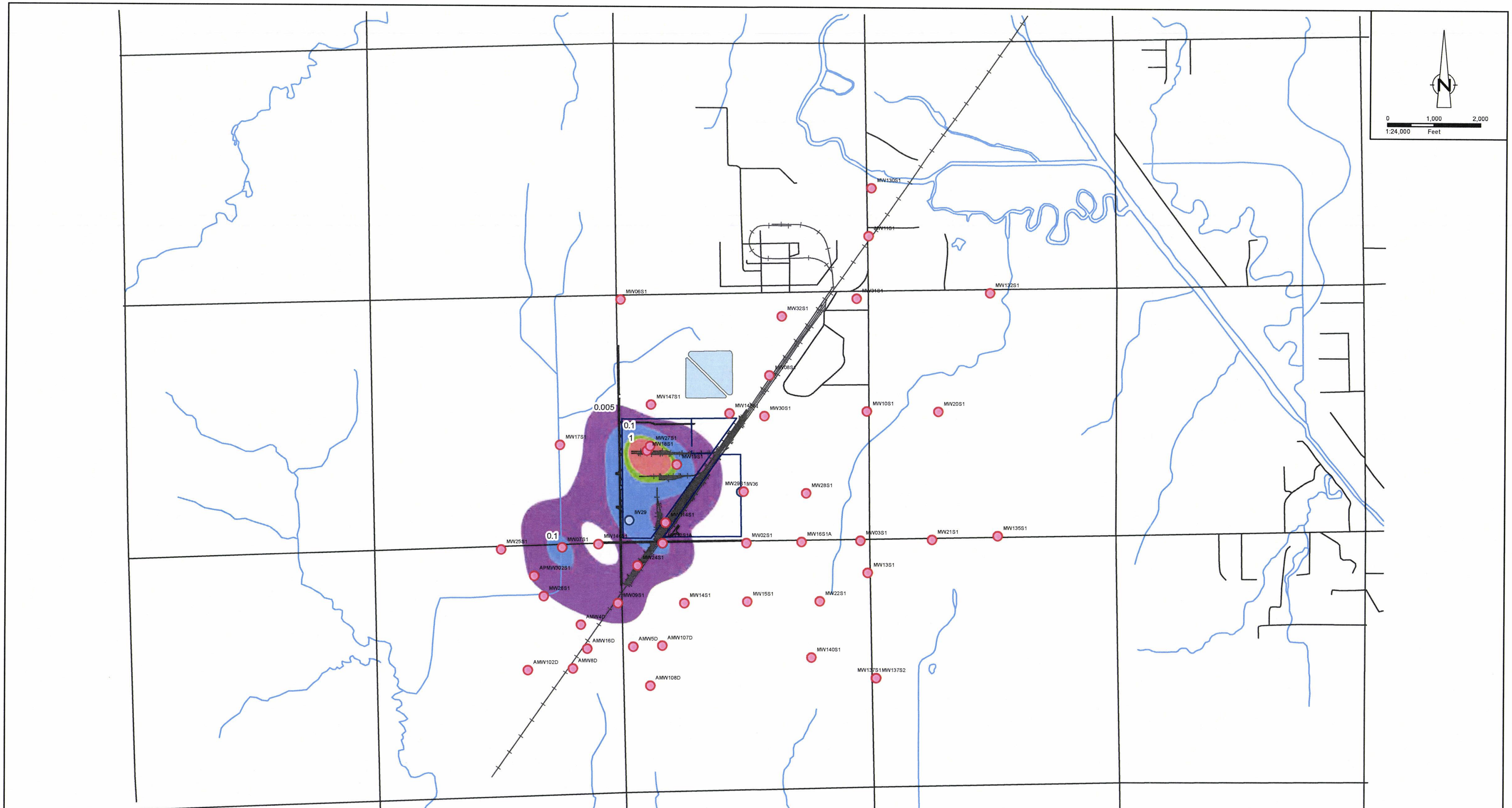
- Interceptor Well
- Monitoring Well
- Production Well

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S2/S3 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 18

JUNE 2015 HEXACHLOROETHANE ISOCONCENTRATION CONTOURS IN S2/S3 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO009 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

- 0.005
- 0.1
- 1
- 2.06

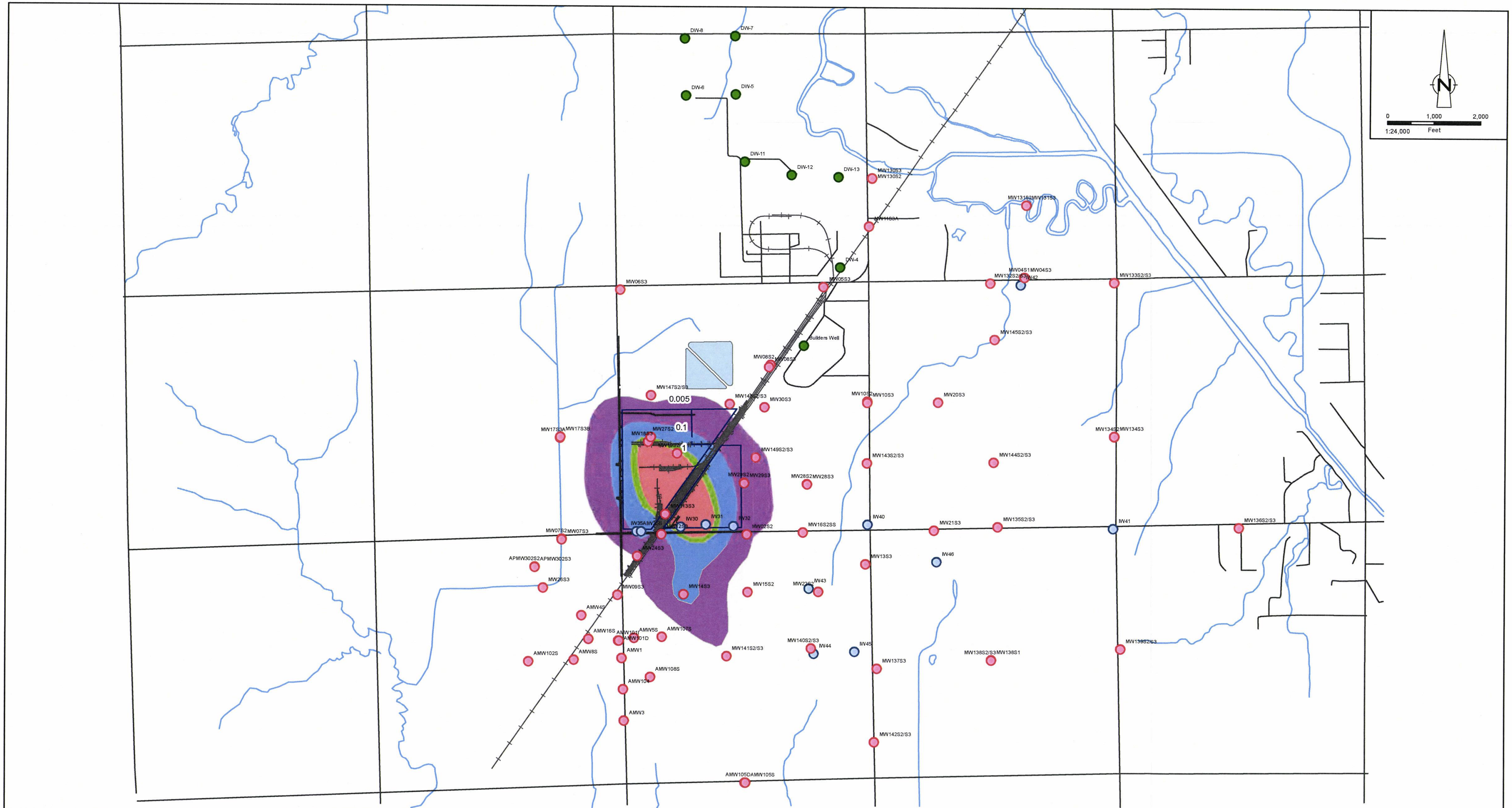
- Interceptor Well
- Monitoring Well

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S1 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 19

JUNE 2015 PERCHLOROETHYLENE ISOCONCENTRATION CONTOURS IN S1 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO010 August 27, 2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

Groundwater Isoconcentration Contour (mg/L)

- 0.005
- 0.1
- 1
- 2.06

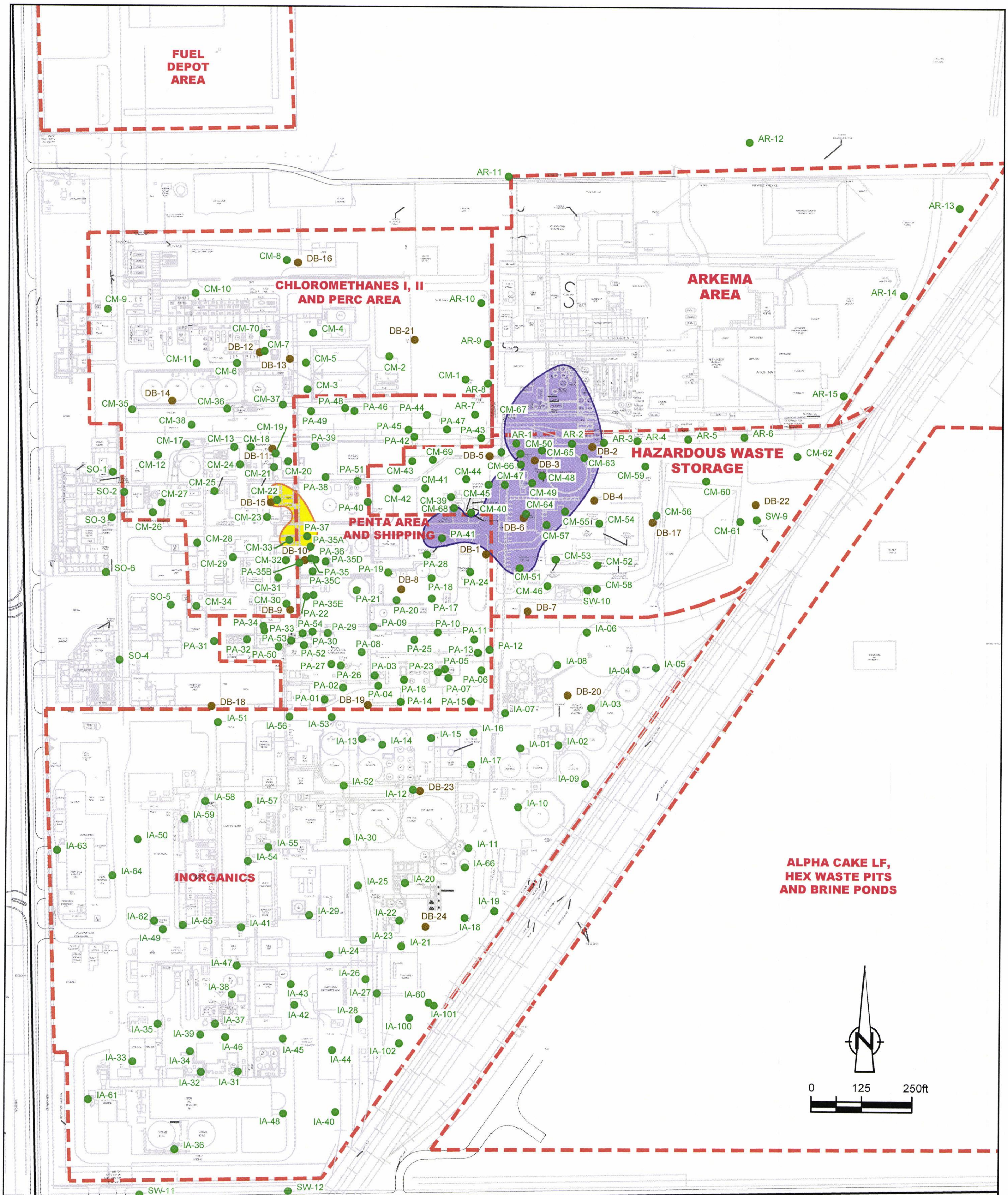
- Interceptor Well
- Monitoring Well
- Production Well

Note: Isoconcentration contours were generated based on the June 2015 groundwater sampling event representative of the S2/S3 aquifer using Surfer 7, log10 transformed data, half the median detection limit for non-detect values, linear 1:1 variogram with anisotropy of 1.4 at 135°, and linear drift.

figure 20

JUNE 2015 PERCHLOROETHYLENE ISOCONCENTRATION CONTOURS IN S2/S3 GROUNDWATER
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046(046)GIS-CO011 August 27, 2015



LEGEND:

STUDY AREAS

PRIMARY CONSTITUENTS INCLUDE HEXACHLORINATED COMPOUNDS

PRIMARY CONSTITUENTS INCLUDE CARBON TETRACHLORIDE OR PERCHLOROETHYLENE

RFI SOIL BORING LOCATION

PHASE II ON-SITE GROUNDWATER INVESTIGATION DEEP DELINEATION BORING

figure 21

ESTIMATED DNAPL LIMITS S4/C3 INTERFACE
OCCIDENTIAL CHEMICAL CORPORATION
Wichita, Kansas

GHD

54046-D22113(046)GN-CO002 AUG 26/2015

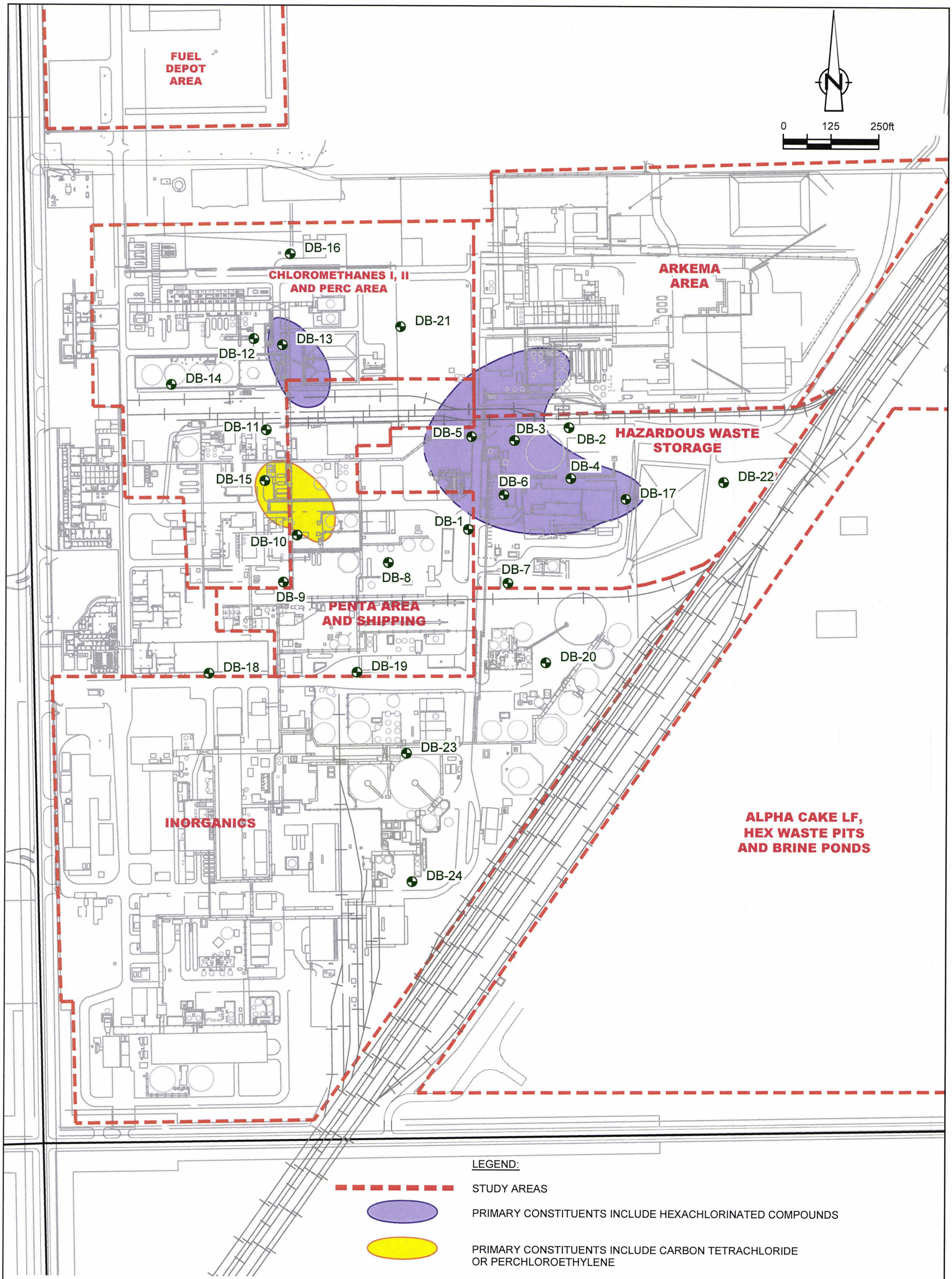


figure 22

ESTIMATED DNAPL LIMITS S3 SAND AND TOP OF C2 CLAY
OCCIDENTIAL CHEMICAL CORPORATION
Wichita, Kansas

54046-D22113(046)GN-CO003 AUG 26/2015

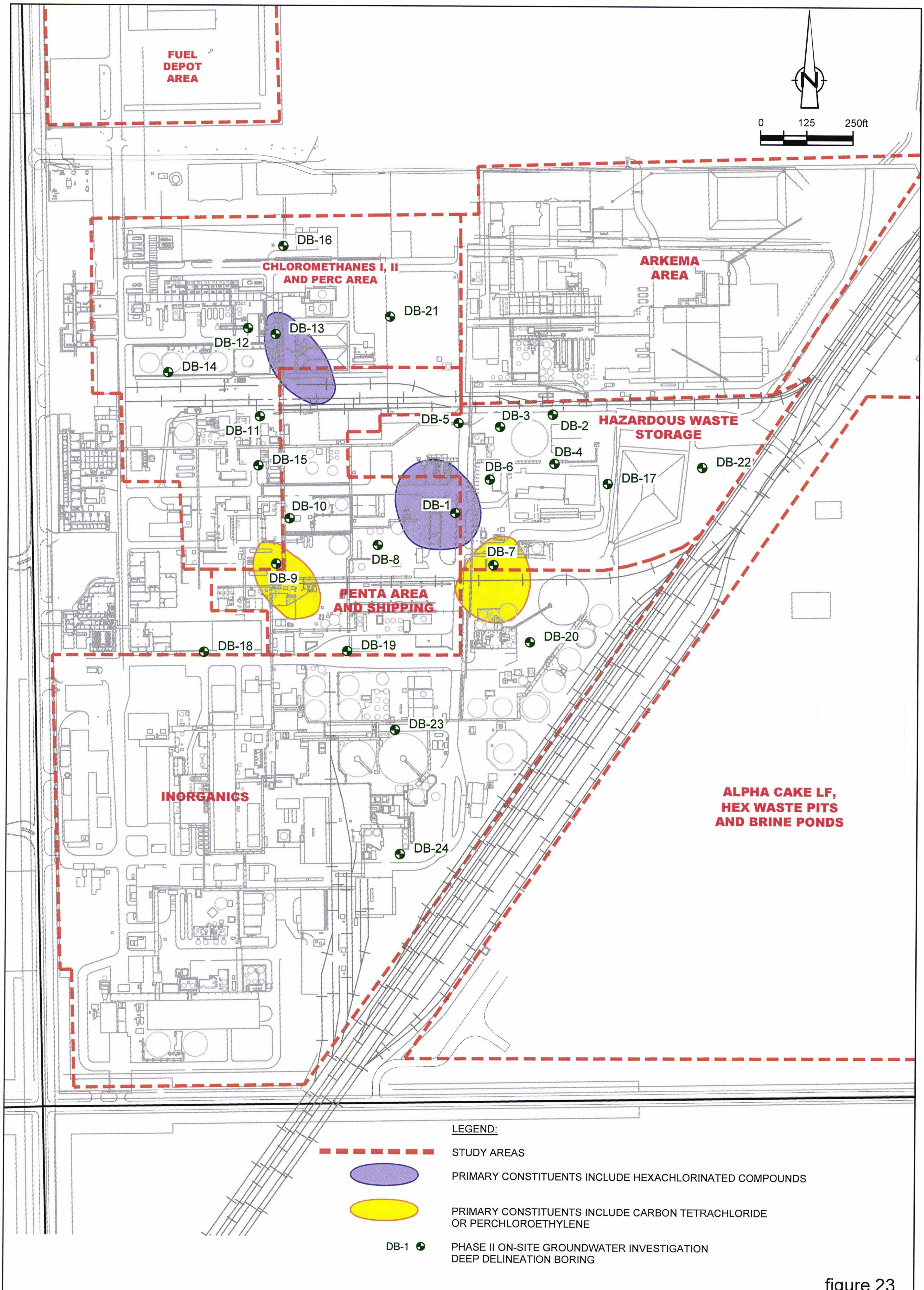
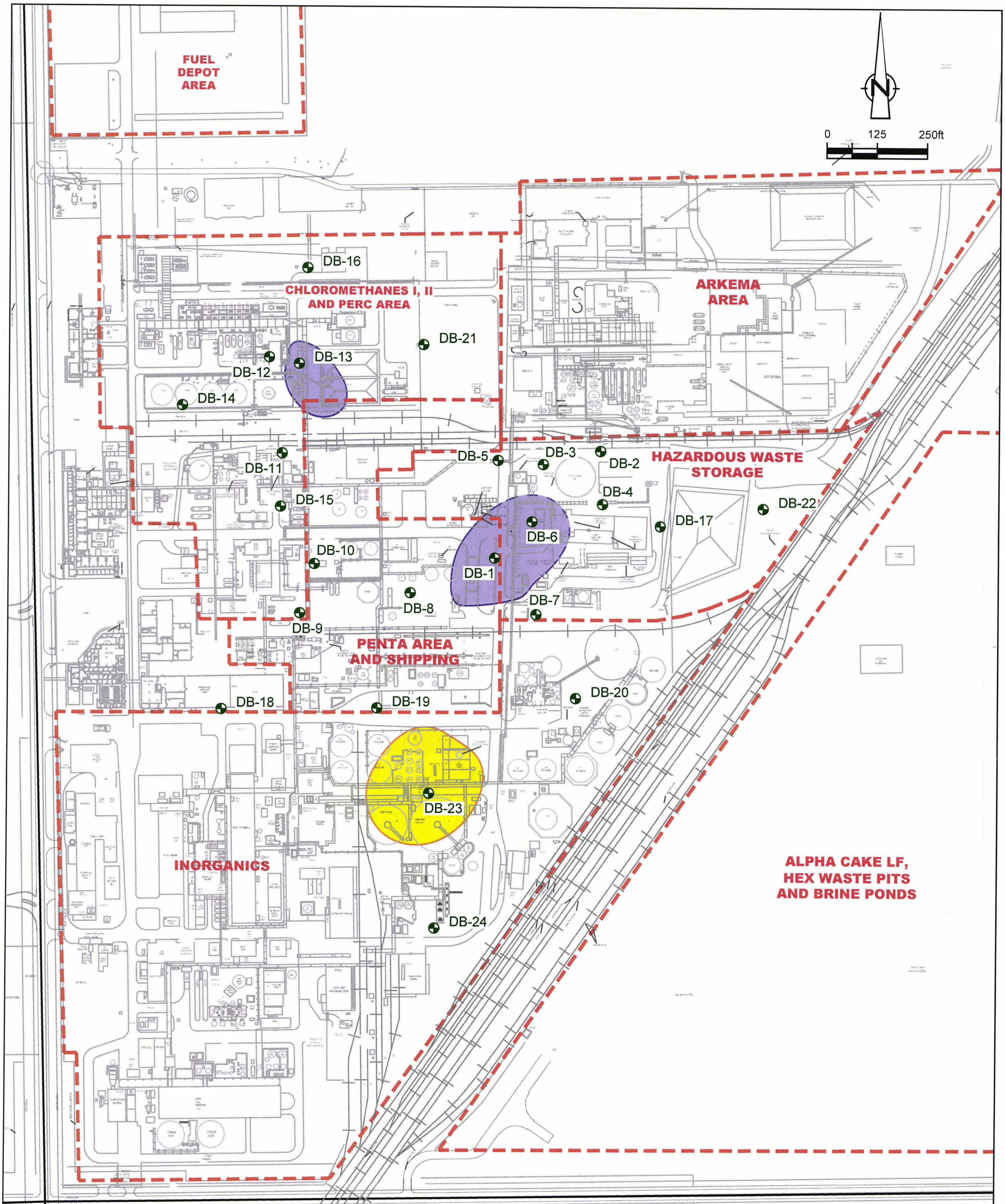


figure 23

ESTIMATED DNAPL LIMITS C2 CLAY
OCCIDENTIAL CHEMICAL CORPORATION
Wichita, Kansas

54046-D22113(046)GN-CO004 AUG 26/2015



LEGEND:

STUDY AREAS

PRIMARY CONSTITUENTS INCLUDE HEXACHLORINATED COMPOUNDS

PRIMARY CONSTITUENTS INCLUDE CARBON TETRACHLORIDE OR PERCHLOROETHYLENE

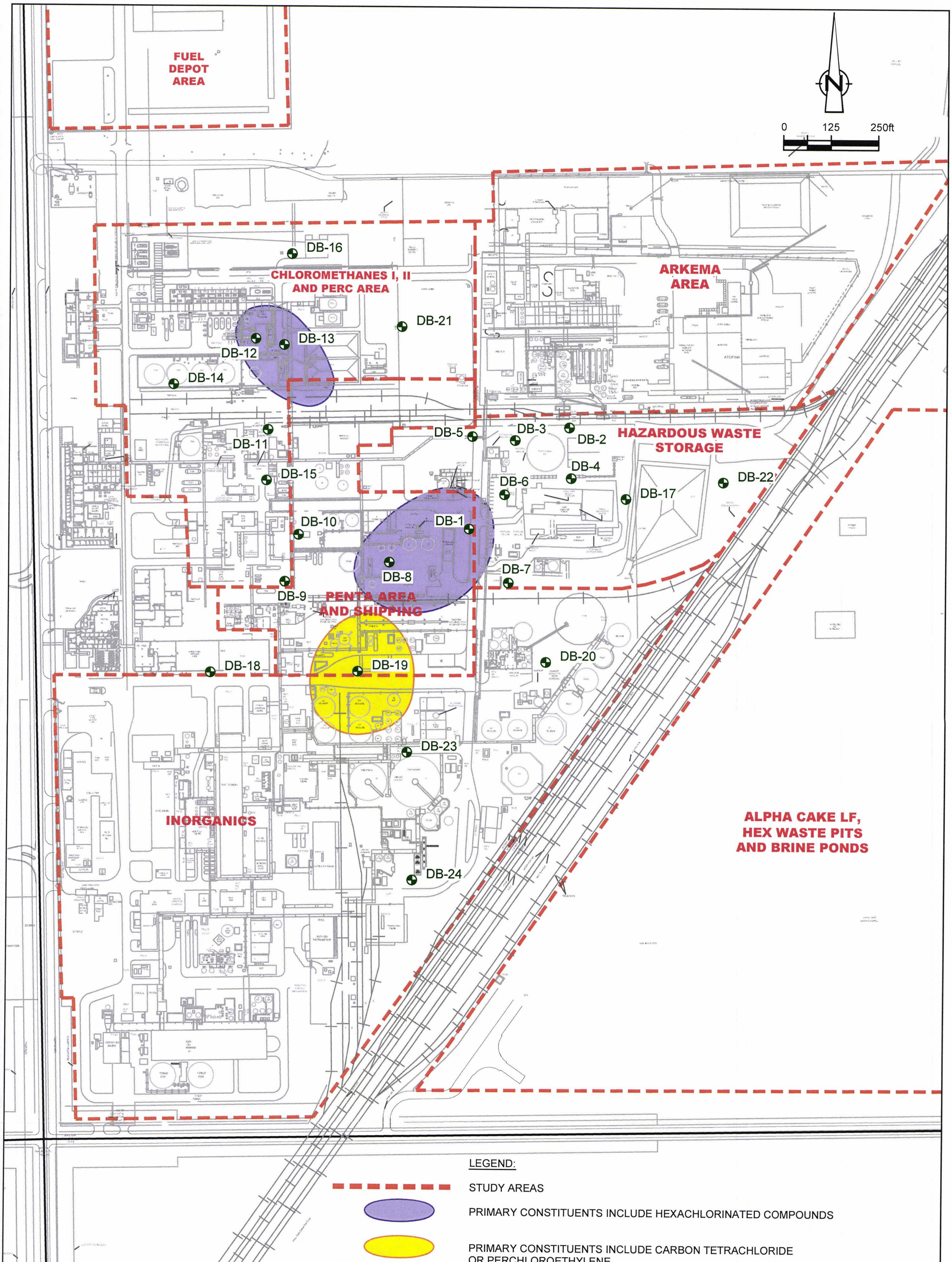
DB-1 PHASE II ON-SITE GROUNDWATER INVESTIGATION DEEP DELINEATION BORING

figure 24

ESTIMATED DNAPL LIMITS S2 SAND AND TOP OF C1 CLAY
OCCIDENTIAL CHEMICAL CORPORATION
Wichita, Kansas

GHD

54046-D22113(046)GN-CO005 AUG 26/2015



LEGEND:

STUDY AREAS

PRIMARY CONSTITUENTS INCLUDE HEXACHLORINATED COMPOUNDS

PRIMARY CONSTITUENTS INCLUDE CARBON TETRACHLORIDE OR PERCHLOROETHYLENE

DB-1 PHASE II ON-SITE GROUNDWATER INVESTIGATION DEEP DELINEATION BORING

figure 25

ESTIMATED DNAPL LIMITS S1 SAND TO TOP OF BEDROCK
OCCIDENTIAL CHEMICAL CORPORATION
Wichita, Kansas

54046-D22113(046)GN-CO006 AUG 26/2015

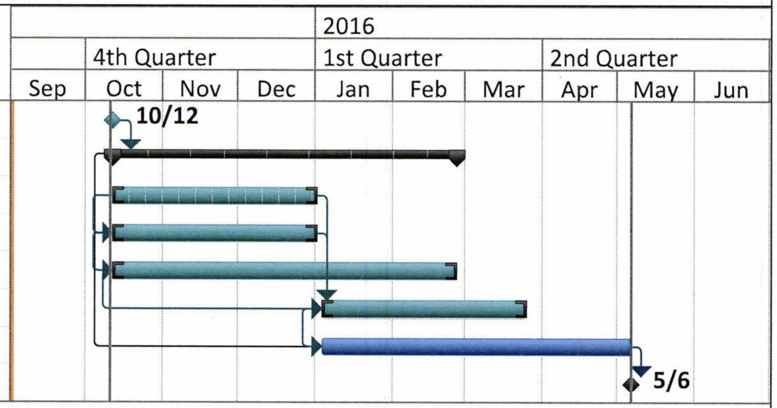
Figure 26

Proposed Corrective Measures Study Schedule

Occidental Chemical Corporation

Wichita, Kansas

ID	Task Name	Duration	Start	Finish
1	CMS Work Plan Approval	0 days	Mon 10/12/15	Mon 10/12/15
2	**Data Evaluation**	**100 days**	**Mon 10/12/15**	**Fri 2/26/16**
3	Soil Remedial Technologies	60 days	Mon 10/12/15	Fri 1/1/16
4	Groundwater ICM Evaluation	60 days	Mon 10/12/15	Fri 1/1/16
5	DNAPL Pilot Study	100 days	Mon 10/12/15	Fri 2/26/16
6	Evaluate Corrective Measures Alternatives	60 days	Mon 1/4/16	Fri 3/25/16
7	Prepare CMS Report	90 days	Mon 1/4/16	Fri 5/6/16
8	Transmit Corrective Measure Study to EPA	0 days	Fri 5/6/16	Fri 5/6/16



Task	External Milestone	Manual Summary Rollup
Split	Inactive Task	Manual Summary
Milestone	Inactive Milestone	Start-only
Summary	Inactive Summary	Finish-only
Project Summary	Manual Task	Deadline
External Tasks	Duration-only	Progress

Tables

Table 1

Human Health Risk Assessment Summary
Corrective Measures Study Work Plan
Wichita, Kansas

Exposure Area	Media	Potential Receptor	Potential Complete Pathway
Process Area	Soil	•Industrial/Commercial Worker •Construction/Utility Worker •Maintenance Worker •Trespasser	•Ingestion •Dermal Contact •Inhalation
	Groundwater	•Future Industrial/Commercial Worker	•Ingestion •Dermal Contact •Inhalation
Non-Process Area	Groundwater	•Future Industrial/Commercial Worker	•Ingestion •Dermal Contact •Inhalation
Landfill Area	Soil	•Construction/Utility Worker •Maintenance Worker •Trespasser	•Ingestion •Dermal Contact •Inhalation
Off-Site	Groundwater	•Future Resident	•Ingestion •Dermal Contact •Inhalation

Note: Soil Vapor will be assessed separately for the occupied buildings

Table 2

Summary of Relevant Technologies and Interim Corrective Measures
Corrective Measures Study Work Plan
Wichita, Kansas

Media	Potential Complete Pathway	Relevant Technology	Existing Interim Corrective Measures
Soil	•Ingestion •Dermal Contact •Inhalation	•Excavation •Capping •Security Barriers •Building Positive Pressure •Institutional Controls	•Landfill Area Cap •ASI Cap •Vapor Intrusion ICM *(Technical Center, Administration and Control Lab Buildings)*
Groundwater	•Ingestion •Dermal Contact •Inhalation	•Extract and Treat •Building Positive Pressure •Institutional Controls	•Groundwater ICM •Vapor Intrusion ICM *(Technical Center, Administration and Control Lab Buildings)*
DNAPL	•Ingestion •Dermal Contact •Inhalation	•Hydraulic Containment •Recovery •Treatment •Institutional Controls	•Groundwater ICM

Note: Soil Vapor will be assessed separately for the occupied buildings

Appendices

Appendix A
DNAPL Mobility and Recoverability Pilot Study Work Plan

Table of Contents

Figure Index

Attachment Index

Acronyms and Abbreviations

DNAPL	Dense Non-Aqueous Phase Liquid
OCC	Occidental Chemical Corporation
EPA	Environmental Protection Agency
U.S.	United States
CMS	Corrective Measures Study
RFI	RCRA Facility Investigation
ICM	Interim Corrective Measure

1. Introduction

The purpose of this Pilot Study Work Plan (Work Plan) is to evaluate the potential mobility and recoverability of dense non-aqueous phase liquids (DNAPLs) at the Occidental Chemical Corporation (OCC) Wichita, Kansas, Facility (Site or Wichita Facility or Facility) located at 6200 S. Ridge Road, Wichita, Sedgwick County, Kansas (United States [U.S.] Environmental Protection Agency [EPA] ID #KSD007482029), **Figure 1**. The results of this pilot study will be used to support the Corrective Measures Study (CMS) for the Site.

For DNAPL to be mobile, it must be present in the subsurface above the residual saturation point for the porous media. DNAPL present at the residual saturation point in the pore space occurs as a discontinuous phase, where it is trapped by capillary forces and cannot migrate under normal subsurface conditions. Research has shown that, even above the residual saturation level, high density and low viscosity DNAPLs (such as the chlorinated compounds found at this Site) cease migrating in relatively permeable media as soon as a few months to a few years following the time of release [1]. While DNAPL mobility is not anticipated at the Site, the potential for DNAPL mobility and recoverability will be evaluated using a combination of laboratory data obtained during the RCRA Facility Investigation (RFI) and field measurements outlined in this Work Plan.

This pilot study will include:

- Collecting field data (DNAPL removal & recovery rates at existing wells).
- Utilizing the pilot study information and historical field and laboratory data to estimate the potential for DNAPL mobility and recoverability with respect to the potential for receptor exposure and integrating the objectives, approach and evaluation criteria for conducting CMS activities for the Site.

2. Background

A comprehensive discussion of Site geology and hydrogeology is provided in the report entitled Phase II Groundwater Report [2,3] and are not replicated here. The S2/S3 aquifer is the principal aquifer system at the Site and generally overlies the C1 clay layer. The S2/S3 aquifer is regionally extensive. The S2 and S3 aquifer units are in hydraulic connection. The S1 aquifer appears to be a confined aquifer which overlies the shale bedrock aquitard. The S1 aquifer is separated from the overlying S2/S3 aquifer by the C1 clay layer.

The Groundwater Interim Corrective Measure (ICM) consists of 14 interceptor wells screened in two aquifer zones to maintain cones of depression within the aquifers to prevent the migration of contaminants [4]. The ongoing effectiveness of the Groundwater ICM is monitored through the semi-annual groundwater gauging and sampling events.

The DNAPL source areas at the Site are associated with historical waste disposal practices. The chemical makeup and areal extent of DNAPL within the Site have been determined [2,3,4]. DNAPL was observed extending through the saturated zone in four areas at the Site: Eastern Hex Area, Northwestern Hex Area, Landfill Hex Area, and CT and Perc Area. The primary compounds that occur with DNAPL at the Site are carbon tetrachloride, chloroform, perchloroethene, pentachlorphenol, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, and benzene hexachloride. The dissolved phase concentrations originating from the identified DNAPL sources are addressed on an ongoing basis by the Groundwater ICM.

3. Pilot Study Methodology

This section of the Work Plan presents the pilot study methodology including selection of pilot study test locations, field data collection, and subsequent data analysis.

3.1 Pilot Study Test Locations

The Pilot Study field activities will focus on wells MW-27S1 and MW-27S2 (**Figure 2**) where DNAPL has been observed in recent semi-annual groundwater monitoring events. DNAPL thicknesses in each well have indicated ranges of several inches to several feet in multiple semi-annual gauging events. Monitoring well construction details for each well are provided in **Attachment 1**. These two monitoring wells are sufficiently representative of Site conditions, and the field study outlined in this Work Plan will provide representative data for the broader DNAPL-impacted area at the Site.

3.2 Field Testing Methodology

The field activities for both wells will be accomplished in two phases: Phase 1 will include a relatively short time period (approximately 4 days) of field data collection; Phase 2 will include field data collection over a longer time period (approximately 3 months). The procedures for Phase 1 and Phase 2 field data collection for each well are outlined below. Phase 1 will provide data on the maximum rate at which DNAPL will enter each well; Phase 2 will provide insight into the attenuation rate of potential DNAPL recovery.

Phase 1 Activities:

1. Adhere to all site and contractor-specific health and safety requirements for this work.
2. Remove the well cap and allow the pressure to stabilize for approximately half an hour. Measure the water level frequently with a battery-operated water level indicator to ensure that stabilization of the water level has occurred. Once the water level has stabilized (i.e., is static) document the static water level in the field log book.
3. Utilize a weighted cord or tape coated with indicator paste to measure the total depth of the well and the DNAPL thickness. Record the total well depth and DNAPL thickness in the field log book. Decontaminate the tape.
4. Install a low-flow DNAPL-rated submersible pump (Xitech 2-inch piston pump or QED Eliminator bladder pump) into the well and set the pump inlet approximately 0.3 feet above the bottom of the well sump.
5. Verify the water level has equilibrated utilizing the procedure in Step 2 and document the water level in the field log book.
6. Verify and record the DNAPL thickness utilizing the procedure in Step 3.

7. Measure the inside diameter of the well casing and calculate the volume of DNAPL in the well utilizing the following formula:

$$V = \pi r^2 h \text{ (7.48 U.S. gallons/cubic feet) (1 liter/1,000 cubic centimeters)}$$

Where:

V	=	volume of water in gallons or liters
π	=	3.142
r	=	radius of well casing (feet or meters)
h	=	DNAPL thickness in the well (feet or meters)

Set the pumping rate to a flow rate between 0.5 and 1.0 liter per minute and immediately record the static water level and DNAPL thickness utilizing the procedures in Steps 2 and 3.

8. Pump the DNAPL until approximately 90% of the volume of DNAPL has been removed; verify the static water level and DNAPL thickness utilizing the procedure in Steps 2, 3 and 7.
9. Once 90% of the DNAPL volume has been removed, gauge the static water level and DNAPL thickness as outlined in Steps 2 and 3 as follows:
   a. Once every 15 minutes for the first hour (Note: the first event is at the time the 90% volume reduction is confirmed). Contact the Project Manager immediately after the data from the first hour of the test is collected to confirm the discharge rates, DNAPL thicknesses and water level elevations. Based upon the initial data the following gauging schedule may be adjusted.
   b. Once every 1 hour for the next four hours.
   c. Once every 4 hours for the next 16 hours.
   d. Once every 16 hours for the next 48 hours.
10. Remove and decontaminate all equipment, install and re-install the well cap.
11. All liquid investigation derived waste will be containerized as it is produced, and it disposed on site via deep well disposal.
12. Obtain and document the flow rates for each of the interceptor wells during the testing period.

Phase 2 Activities:

1. Return to the well every other week for 12 weeks and perform the following:
   a. Gauge static water level and DNAPL thickness as outlined in Phase 1 Steps 1, 2 and 3
   b. Perform Phase 1 Steps 4 through 8 above.
   c. Perform Phase 1 Steps 10, 11 and 12 above.
2. Contact the Project Manager immediately after the data is collected to confirm the discharge rates, DNAPL thicknesses and water level elevations.

3.3 Analysis of Results

The Phase 1 and Phase 2 field data collected during the pilot study will be processed along with the laboratory and field data collected during the RFIs to estimate the potential for DNAPL mobility and recoverability with respect to the potential for receptor exposure.

4. References

[1] U.S. Environmental Protection Agency. September 2009. *Assessment and Delineation of DNAPL Source Zones at Hazardous Waste Sites.* EPA/600/R-09/119

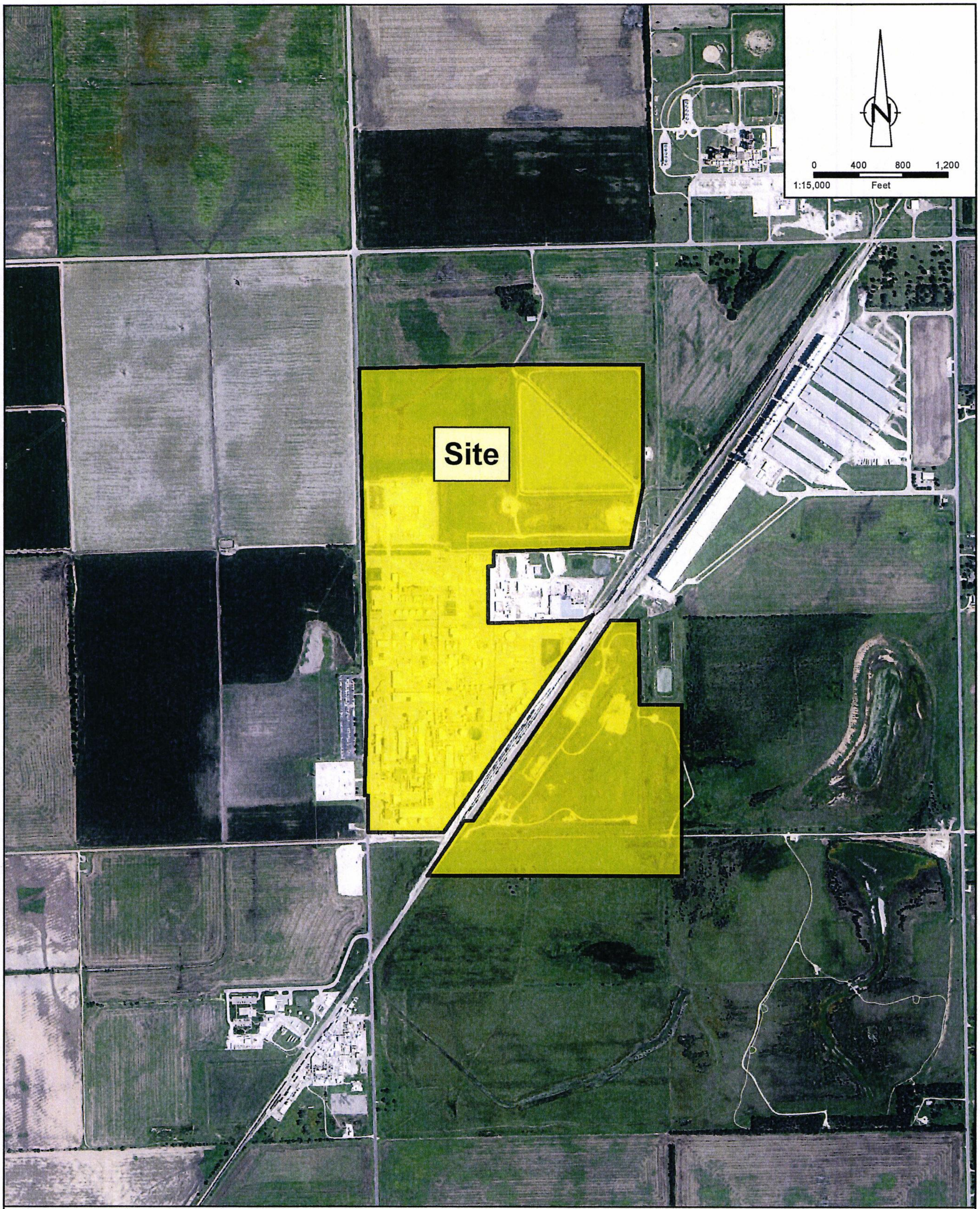
[2] Conestoga-Rovers & Associates, Inc. February 2014. Phase II On-Site Groundwater RFI Summary Report, Occidental Chemical Corporation Facility, Wichita, Kansas.

[3] Conestoga-Rovers & Associates, Inc. June 2014. Phase II On-Site Groundwater RFI Supplemental Report, Occidental Chemical Corporation Facility, Wichita, Kansas.

[4] GHD Services, Inc. August 2015. Human Health Risk Assessment, Glenn Springs Holdings, Inc., Occidental Chemical Corporation Facility, Wichita, Kansas.

EPRI. August 2015. *Generic Work Plan to Assess Dense Non-Aqueous Phase Liquid (DNAPL) Mobility in the Subsurface at Manufactured Gas Plant (MGP) Sites.* 30020033462.

Kueper, B. H., Stroo, H. F., Vogel, C. M., Ward, C. H. 2014. *Chlorinated Solvent Source Zone Remediation.* SERDP ESTCP Environmental Remediation Technology, Vol 7

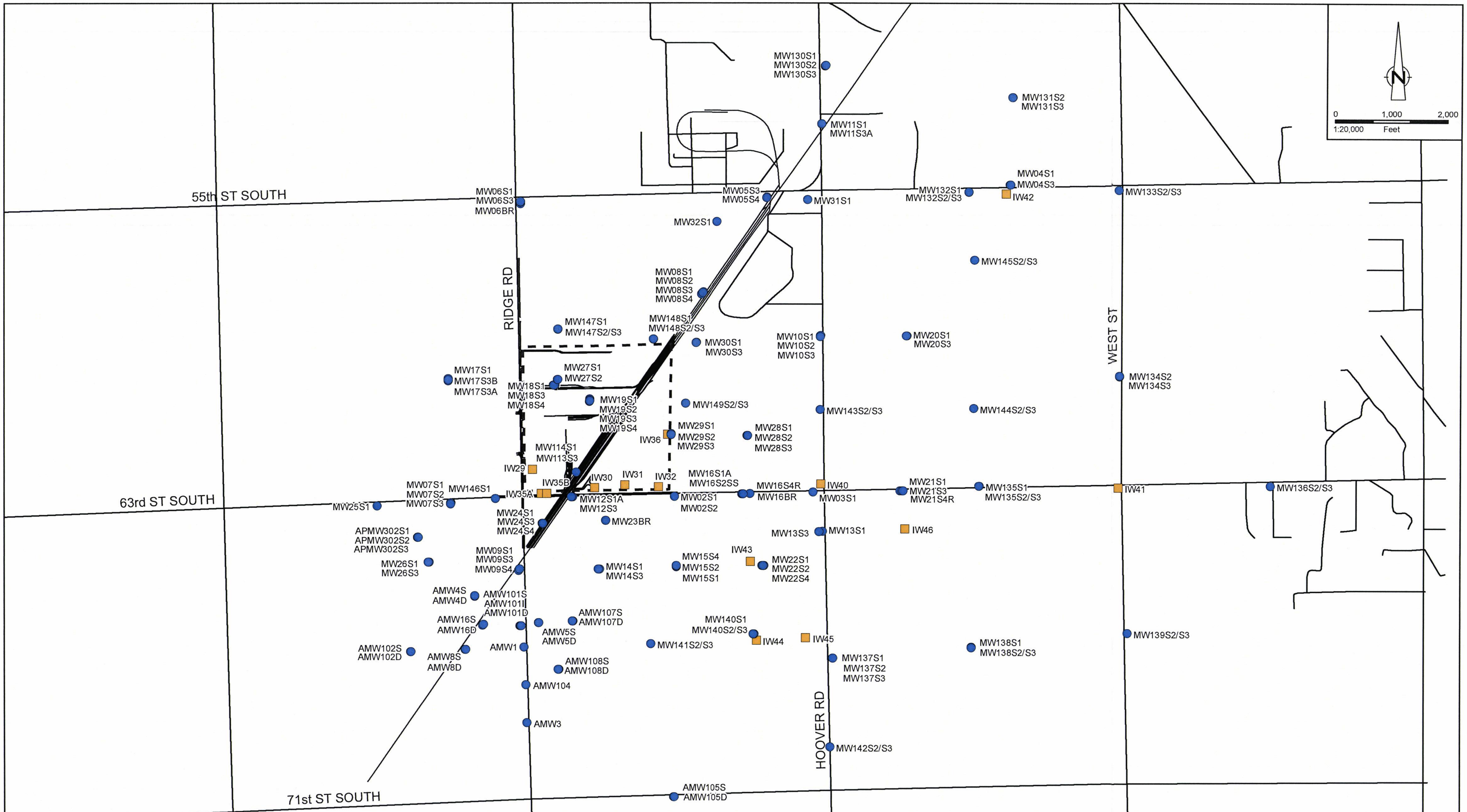


Source: NAIP Imagery of Kansas, 2014 – U.S. Department of Agriculture (USDA) Farm Service Agency, Aerial Photography Field Office.
Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

figure 1

SITE LOCATION
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046-D22113(046)GIS-OT001 Aug 26/2015



Coordinate System: NAD 1983 StatePlane Kansas South FIPS 1502 Feet

Legend

- Interceptor Well
- Monitoring Well
- Approximate Site Boundary
- Roads
- Railroad

GHD

figure 2

MONITORING AND INTERCEPTOR WELL LOCATIONS
OCCIDENTAL CHEMICAL CORPORATION
Wichita, Kansas

054046-D22113(046)GIS-OT007 September 01, 2015

Attachment 1
Monitoring Well Construction Logs

MW2751

USE TYPEWRITER OR BALL POINT PEN-PRESS FIRMLY, PRINT CLEARLY.

WATER WELL RECORD
KSA 82a-1201-1215

Kansas Department of Health and Environment-Division of Environment (Water well Contractors) Topeka, Kansas 66620

1. Location of well:	County: Sedgwick	Fraction: NE 1/4 NW 1/4 SW 1/4	Section number: 27	Township number: T 29 S	Range number: R 1 E/W

2. Distance and direction from nearest town or city: 3 miles south of Wichita International Airport
Street address of well location if in city:

3. Owner of well: Vulcan Materials Company
R.R. or street: 6200 So. Ridge Road, Box 545
City, state, zip code: Wichita, KS 67201

4. Locate with "X" in section below: (N, NW, NE, W, E, SW, SE, S; X in SW quarter; 1 Mile)

Sketch map:
No. 27-A West Well (Deep)
6" Monitor Well
800' East & 2000 North of
SW Corner Sec. 27 (Approx.)

6. Bore hole dia. 11 in. Completion date 8/16/77
Well depth 111 ft.

7. ___ Cable tool X Rotary ___ Driven ___ Dug ___ Hollow rod ___ Jetted ___ Bored ___ Reverse rotary

8. Use: ___ Domestic ___ Public supply X Industry ___ Irrigation ___ Air conditioning ___ Stock ___ Lawn ___ Oil field water ___ Other

9. Casing: Material ___ Threaded ___ Welded ___ RMP ___ PVC X
Dia. 6 in. to 54 ft. depth
Dia. 6 107-111 depth
Height: Above or below Surface 2.22 in.
Weight 4.07 lbs./ft.
Wall Thickness: inches or gage No. .316

5. Type and color of material	From	To
Top Soil	0	2
Clay, silty, brown	2	9
Clay, sandy, red & brown	9	15
Sand & gravel, fine to coarse	15	30
Clay, sandy, brown & gray	30	40
Sand and gravel, fine to coarse	40	53
Clay, brown and gray	53	75
sand and gravel, fine	75	80
Clay and sandy clay, brown	80	90
Sand and gravel, fine	90	105
Blue shale and hard limey shale	105	109

(Use a second sheet if needed)

10. Screen: Manufacturer's name Clarke
Type PVC Dia. 6"
Slot/gauze 1/16" Length 10'
Set between 97 ft. and 107 ft.
___ ft. and ___ ft.
Gravel pack? yes Size range of material 3/8-200

11. Static water level: 61.7 ft. below land surface Date 8/1/77 (mo./day/yr.)

12. Pumping level below land surface:
___ ft. after ___ hrs. pumping ___ g.p.m.
___ ft. after ___ hrs. pumping ___ g.p.m.
Estimated maximum yield Bailed 20 g.p.m.

13. Water sample submitted: ___ Yes X No Date ___ (mo./day/yr.)

14. Well head completion: ___ Pitless adapter NO Inches above grade

15. Well grouted? yes
With: X Neat cement ___ Bentonite ___ Concrete
Depth: From 0 ft. to 94 ft.

16. Nearest source of possible contamination: ___ ft. Direction ___ Type PLANT
Well disinfected upon completion? ___ Yes X No

17. Pump: X Not installed
Manufacturer's name ___
Model number ___ HP ___ Volts ___
Length of drop pipe ___ ft. capacity ___ g.p.m.
Type: ___ Submersible ___ Turbine ___ Jet ___ Reciprocating ___ Centrifugal ___ Other

18. Elevation:
Topography: ___ Hill ___ Slope ___ Upland ___ Valley

19. Remarks:
Elev. Top 6" Casing 1309.5
Elev. ~~XXXXXXX~~ Ground 1307.28

20. Water well contractor's certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Clarke Well & Equip. Inc. ~~XXXX~~ 183
Business name / License No.
Address Great Bend, KS 67530
Signed [signature] Date 2/14/7
Authorized representative

Form WWC-5

Forward the white, blue and pink copies to the Department of Health and Environment

MW27S2

MW27B

USE TYPEWRITER OR BALL POINT PEN—PRESS FIRMLY, PRINT CLEARLY.

WATER WELL RECORD
KSA 82a-1201-1215

Kansas Department of Health and Environment—Division of Environment
Water well Contractors
Topeka, Kansas 66620

1. Location of well:	County: Sedgwick	Fraction: NE 1/4 NW 1/4 SW 1/4	Section number: XX 27	Township number: T 29 S	Range number: R 1 E (W)

2. Distance and direction from nearest town or city: 3 miles south of Wichita International Airport
Street address of well location if in city:

3. Owner of well: Vulcan Materials Company
R.R. or street: 6200 So. Ridge Road
City, state, zip code: Wichita, Ks 67201

4. Locate with "X" in section below: (X in SW quarter; N, S, E, W; 1 Mile)

Sketch map:
No. 27-B East Well Shallow
6" Monitor Well
810 East & 2000' North of
SW corner Sec. 27 (Approx.)

6. Bore hole dia. 11 in. Completion date 10/6/77
Well depth 87 ft.

7. __ Cable tool X Rotary __ Driven __ Dug __ Hollow rod __ Jetted __ Bored __ Reverse rotary

8. Use: __ Domestic __ Public supply X Industry __ Irrigation __ Air conditioning __ Stock __ Lawn __ Oil field water __ Other

9. Casing: Material PVC Height: Above or below Surface 2.22 in.
Threaded ___ Welded ___ Weight 4.07 lbs. ft.
RMP ___ PVC X Wall Thickness inches or gage No. .316
Dia. 6 in. to 77 ft. depth
Dia. 6 in. 83-87 ft. depth

10. Screen: Manufacturer's name Clarke
Type PVC Dia. 6"
Slot/gauze 1/16" Length 6'
Set between 77 ft. and 83 ft.
___ ft. and ___ ft.
Gravel pack? yes Size range of material 3/8-200

11. Static water level: 61 ft. below land surface Date 10/6/77 mo./day/yr.

12. Pumping level below land surface:
___ ft. after ___ hrs. pumping ___ g.p.m.
___ ft. after ___ hrs. pumping ___ g.p.m.
Estimated maximum yield Bailed 20 g.p.m.

13. Water sample submitted: ___ Yes X No Date ___ mo./day/yr.

14. Well head completion: NO
___ Pitless adapter ___ Inches above grade

15. Well grouted? yes
With: X Neat cement ___ Bentonite ___ Concrete
Depth: From 0 ft. to 74 ft.

16. Nearest source of possible contamination: PLANT
ft. ___ Direction ___ Type ___
Well disinfected upon completion? ___ Yes X No

17. Pump: X Not installed
Manufacturer's name ___
Model number ___ HP ___ Volts ___
Length of drop pipe ___ ft. capacity ___ g.p.m.
Type: ___ Submersible ___ Turbine ___ Jet ___ Reciprocating ___ Centrifugal ___ Other

5. Type and color of material	From	To
Top Soil	0	2
Clay - Silty, Brown	2	9
Clay - Red	9	16
Sand and Gravel, fine to coarse	16	34
Clay - brown and gray	34	41
Sand and gravel, fine to coarse	41	53
Clay - brown and gray	53	76
Sand and Gravel - Fine	76	83
Clay - Brown and Gray	83	87

(Use a second sheet if needed)

18. Elevation:
Topography: ___ Hill ___ Slope ___ Upland ___ Valley

19. Remarks:
Elev. Top of Casing 1309.5
Elev. Ground 1307.28

20. Water well contractor's certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Clarke Well & Equip. Inc. 185
Business name
Great Bend, KS 67530
Address
Signed [signature] Date 2-14-
Authorized representative

Forward the white, blue and pink copies to the Department of Health and Environment

Form WWC-5

www.ghd.com